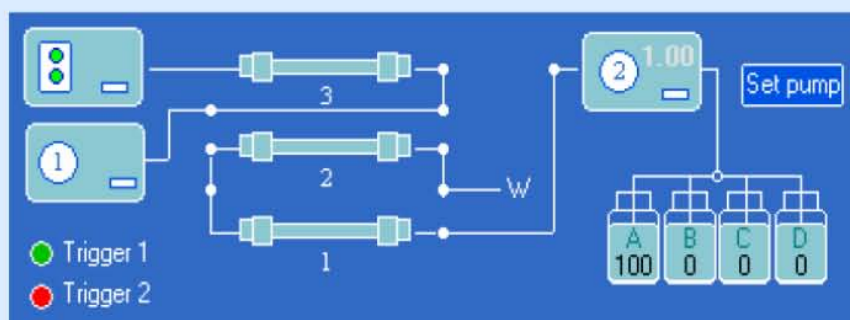


PC-Technologies

LC and LC/MS

Valve Systems



VICI : Valve S'ware Upgrade for Agilent
– Interfaces to ChemStation
Gradient Valve Systems
Auto LC Injector
LC Column CleanUp Station
2D LC System



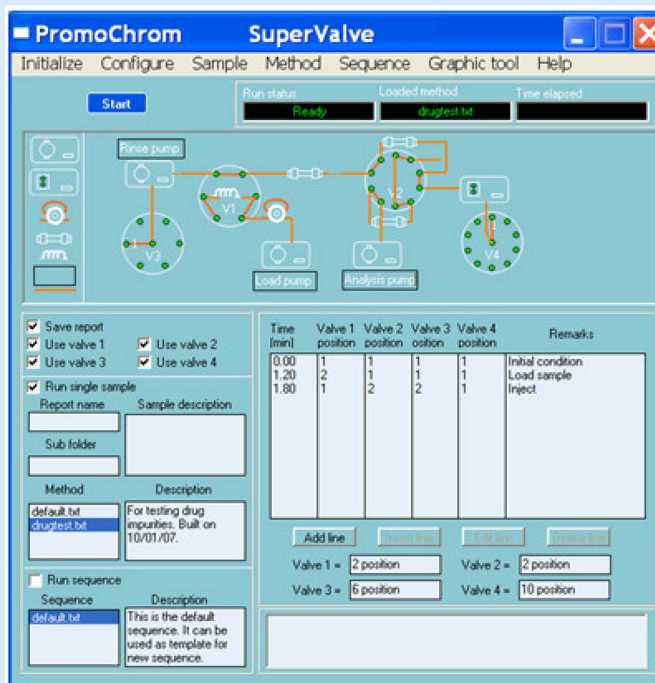
LC-04 Cleanup Station

LC-04 Cleanup Station includes 3 models: LC-04SP, LC-04MD, and LC-04CL. They are designed to meet different needs in application and the budget. The 3 models share the same features as follows:

- **Easy installation.** The software will search for the instrument automatically. There is no need for setting the computer communication parameters.
- **User friendly software.** The graphical user interface provides a real time display of valve positions and services as a control panel.
- **Easy integration with LC or LC-MS.** LC-04 can be synchronized with other instruments either using a remote cable or through dynamic data exchange. When working with an Agilent instrument, the LC-04 software will start data exchange automatically. Remote cable is not necessary.

LC-04SP valve system provides a versatile platform for building valve based solutions. It can have up to 4 valves. Each valve can be a 2-position/6-port valve, 2-position/8-port valve, 2-position/10-port valve, 6-position stream selection valve, or a 10-position stream selection valve.

The most outstanding feature of LC-04SP is its editable valve diagram. The software provides a graphic tool box. Users can design and edit the valve diagram according to their applications. The software will memorize the diagram. The other special feature of LC-04SP is its high flexibility. Users can choose the number and type of valves according to their needs and can add more valves later.



LC-04MD is a pre-configured valve system for multidimensional LC separation. It simplifies the valve control. Users only need to use simple commands (such as “load sample to column 1”, “elute column 2”, etc.) while the control software looks after all the necessary operations of the hardware. Now the chemists can focus on the properties of the columns in method development. The methods can also be easily understood by other users when they are transferred for routine use.

LC-04MD consists of two high pressure switching valves, a solvent mixing valve, an HPLC pump, and the control software. The solvent mixing valve is used to mix up to 4 types of solvents. The high pressure switching valves are pre-connected to fit up to 3 columns. It upgrades a normal HPLC to a multidimensional system.

A very useful feature of LC-04MD is mobile phase modification. When pump 1 is used to elute analytes from column 2 to column 3, the mobile phase may not be suitable for column 3. Then pump 2 can be connected between column 2 and column 3 to have the mobile phase from column 2 modified.

Among the typical applications of LC-04MD are protein characterization in proteomic research and sample cleanup for multi residue analysis of pesticides.

All the components of LC-04MD can be held in a container and inserted into the stack of LC or LC-MS Instruments.



A run can be started by the start/stop button, a remote signal from LC, or by dynamic data exchange

Available methods and sequence are listed and can be loaded by a mouse click

LC-04MD PromoChrom Technologies

Initialize Simulation Sample Method Sequence Help

Stop

Run status: **Running**
Loaded method: **test1.txt**
Time elapsed: **0.65**

Trigger 1 (green dot)
Trigger 2 (green dot)

Procedures

	Solvent composition				Flow rate	Duration [Min]
	A%	B%	C%	D%		
Load sample to column 1	100.0	0.0	0.0	0.0	1.00	0.40
Load sample to column 1	100.0	0.0	0.0	0.0	1.00	30.00
Load sample to column 2	100.0	0.0	0.0	0.0	1.00	0.50
Load sample to column 3+mix	0.0	0.0	100.0	0.0	1.00	0.40
Link column 2 to column 1	100.0	0.0	0.0	0.0	2.00	0.20
Set trigger 1 high	100.0	0.0	0.0	0.0	0.00	0.50

Save report ☒ Use mix valve ☒
Use load pump ☒ Stop pump at end of run ☒
Run single sample ☒
Report name: Sample description:
Sub folder:
Method: Description:
default.txt
test1.txt
test2.txt
Run sequence ☐
Sequence: Description:
default.txt
seq1.txt
A sequence for testing start/stop response.

Add line: A THF+Hexane Column 1 GPC 500 x 7 mm
Insert line: B Acetonitrile Column 2 CN 20 x 4.6 mm
Edit line: C water Column 3 C18 250 x 4.6 mm
Delete line: D buffer Run time 32

Instrument is connected to RS232 port 3.
Load pump is connected to RS232 port 4.

Graphical user interface not only display run status but also serves as control panel. Pump and mixing valve can be switched by a mouse click.

Parameters for a method is easy to set and easy to understand

Notice panel gives instrument status and troubleshooting tips

User interface of the control software

LC-04CL has similar components and features as LC-04MD. The difference is mainly in the software. LC-04CL is pre configured for on-line sample cleanup and enrichment.

So far the most successful application of on-line sample preparation is in analysis of biological fluid samples. It relies mainly on the use of restricted access material (RAM). RAM type columns have hydrophilic surface and hydrophobic pores. Small molecules can be retained in the pores like on a reverse phase column while large molecules (such as proteins) are blocked from entering the pores and removed using an aqueous solution.

In a typical application, sample from injector is loaded to the cleanup cartridge. The cartridge is then rinsed using pump 2 (from LC-04CL), while pump 1 (from HPLC) is conditioning the analytical column. After the trapped interference on the cartridge has been removed, the analytes are back flushed to the analytical column for chromatographic separation and detection.

When transferring the analytes from the cleanup cartridge to column, mobile phase modification may be used to narrow down the peaks. This can be done by simply using procedure "Load sample to column + mix" and let pump 2 to use 100% water.

LC-04 Cleanup Station PromoChrom ...

Initialize Simulation Sample Method Sequence Help

Stop

Run status: Running

Loaded method: test1.txt

Time elapsed: 0.26

☒ Trigger 1

☒ Trigger 2

☒ Save report

☒ Use mix valve

☒ Use load pump

☒ Stop pump at end of run

☒ Run single sample

Report name:

Sample description:

Sub folder:

Method:

Description:

☐ Run sequence

Sequence:

Description:

Procedures	Solvent composition				Flow rate	Duration (Min)
	A%	B%	C%	D%		
Load sample to cartridge	0.0	100.0	0.0	0.0	4.00	0.20
Rinse cartridge	0.0	100.0	0.0	0.0	4.00	1.00
Load sample to column + mix	0.0	100.0	0.0	0.0	0.00	1.00
Elute column + mix	30.0	70.0	0.0	0.0	0.00	0.20
Set trigger 2 high	100.0	0.0	0.0	0.0	0.00	0.20

Add line:

Insert line:

Edit line:

Delete line:

Column:

Cartridge:

Run time:

Instrument is connected to RS232 port 3.
Load pump is connected to RS232 port 4.

Software for LC-04CL

LC-05 Auto Injector

LC-05 Auto Injector includes an injection valve, a solvent selection valve, and a dosage pump. It is for automatic introduction of samples from a fixed source for HPLC analysis. Typical applications are on-line monitoring. It enables a normal HPLC to fulfill tasks that cannot be done using a HPLC auto sampler.

By adding a valve based fraction collector, large scale purification can be achieved using an analytical scale HPLC by repeated injection of one sample.

The instrument is designed to work with any HPLC or LC-MS that has a remote output (TTL or contact closure). In case of Agilent instruments, the LC-05 software will automatically modify the Agilent Chemstation to enable dynamic data exchange.



LC-05 Auto Injector PromoChrom Technologies

Initialize Sample Method Sequence Help

Start Run status: Ready Loaded method: PLantCollect.txt Repeated No.: Time elapsed:

☐ Save report ☒ Use collection

☒ Run single sample

Sample name: Description:

Method: **allAction.txt** Description: For purification of herb extract. June 8, 2006.

Repeat No.: 0 Interval (Min): 0

☐ Run sequence

Sequence: **default.txt** Description: This is the default sequence. It can be used as template for building new sequence

Repeat No.: 0 Interval (Min): 0

Time (min)	Action	Duration (min)
0.00	Load A	0.10
0.12	Load B	0.10
0.30	Inject	
0.30	Send start	
0.30	Set trigger 1 high	
0.30	Set trigger 2 high	
1.50	Collect fraction 1	0.20
3.00	Collect fraction 2	0.10
4.00	Collect fraction 3	0.30
5.50	Collect fraction 4	0.50
7.00	Collect fraction 5	0.20
9.00	Collect fraction 6	0.30
11.00	Send stop	
11.00	Set trigger 1 high	
11.00	Set trigger 2 low	

LC flow rate: 1.5

Stop time: 11

A= Herb extract

B= Methanol for cleaning

Add line Insert line Edit line Delete line

Instrument is connected through RS232 port 1.

Control software for LC-05 Auto injector

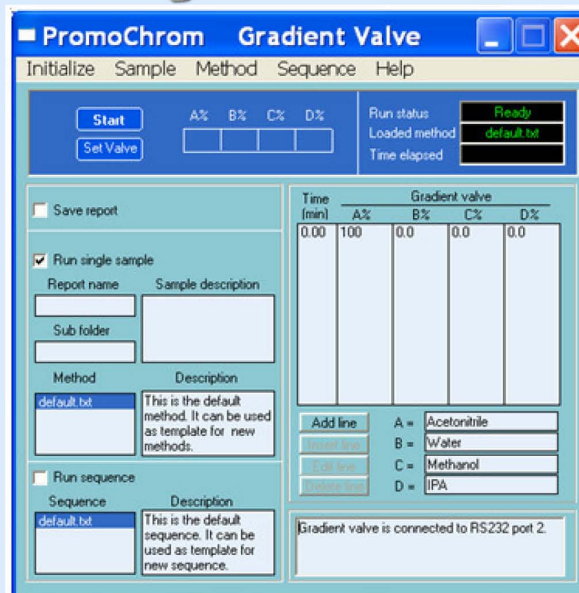
Gradient Valve

Gradient valve provides an economical solution for upgrading an isocratic pump to a quaternary gradient pump. It includes a 4-channel gradient valve, a valve controller, and the control software.

It is designed to work with any HPLC pump that has a remote output. When working with an Agilent HPLC pump, it can also use dynamic data exchange for synchronization. A remote cable is not necessary.

The installation is easy. The software will search for the valve and set computer communication parameters automatically.

The user friendly design and the on-line help information make the use of the product straight forward. No special training is necessary.



Degasser

When an isocratic pump is upgraded to a quaternary pump, an on-line degasser should be used. This is because bubbles can be easily formed when two solvents are mixed during a gradient run. Our mini degasser has excellent degassing efficiency and reliability. Its attractive price and small footprint make it a nice match with the gradient valve.

Specifications:

Number of Channels: 4 or 5
Internal Channel Volume: 480 uL
Wetted Parts: Peek and Teflon® AF
Dimension: 2.9 x 5.0 x 9.8 in (W x H x D)
Power: 15 to 24 VDC @ 0.85 A max (0.5 A typical)
Weight: 6lb (2.7kg)



VICI Valve Control Software

VICI valve control software automates operation of VICI 2-position valves. It works directly with the VICI 2-position microelectric actuators through a RS232 port or a USB port with a USB/RS232 converter.

The software allows VICI valves to be integrated into an Agilent HPLC system using dynamic data exchange.

The valve control software is easy to set up. The software automatically searches for the valve. There is no need for user to set RS232 port number and other communication parameters. The software will even build macros into Agilent Chemstation for data exchange. No manual operations are involved. It is really a plug and play product.

The valve control software is easy to use. The software monitors the status of the valve regularly. The status is displayed for easy observation. The position of valve is shown using LED icons A and B. The valve can be directly switched by clicking the two LED icons. For a more automatic control, methods or sequences can be used. The methods and sequences can be saved and loaded for repeated use. A run can be started by clicking at the start button. When used with an Agilent 1100 LC or 1200 LC, the run of valve can be synchronized with the HPLC using dynamic data exchange. There is no remote cable involved.

The screenshot shows the VICI valve controller software window. It has a title bar 'VICI valve controller' and three tabs: 'Initialize', 'Method', and 'Sequence'. The 'Method' tab is active. The interface includes a 'Start' button, two LED icons labeled 'A' (red) and 'B' (green), and a 'Run status' section showing 'Ready', 'Loaded method' as 'test2.txt', and 'Time elapsed'. Below this, there are sections for 'Single run' and 'Sequence run'. The 'Single run' section has a list of methods: 'default.txt', 'test1.txt', and 'test2.txt' (selected). The 'Sequence run' section has a list of sequences: 'default.txt' and 'seq1.txt' (selected). A table on the right shows the 'Time (min)' and 'Position' for the selected method. The table has two columns: 'Time (min)' and 'Position'. The data rows are: 0.00 A, 0.30 B, and 0.50 A. At the bottom, there is a 'Valve status' section showing 'Valve is connected to RS232 port 3.' and a 'Notice' panel. Annotations with arrows point to various parts of the interface: 'LED icons for position status and for direct switch by a mouse click' points to the A and B icons; 'Available methods and sequences are listed and can be loaded by a mouse click' points to the method and sequence lists; 'Valve status and help tips are displayed in the notice panel' points to the bottom status area; 'Methods and sequences can be saved and loaded for repeated use' points to the 'Method' and 'Sequence' tabs; 'Parameters for a method' points to the table; and 'Application type of valve is memorized as reminder' points to the 'A = Load position' and 'B = Inject position' labels.

LED icons for position status and for direct switch by a mouse click

Available methods and sequences are listed and can be loaded by a mouse click

Valve status and help tips are displayed in the notice panel

Methods and sequences can be saved and loaded for repeated use

Parameters for a method

Application type of valve is memorized as reminder

Time (min)	Position
0.00	A
0.30	B
0.50	A

A = Load position
B = Inject position

PC Tech ₂₀₁₁



Valve Systems for LC & LC/MS

Instrument Catalog

Auto SPE



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SPE-01 Cleanup Station

SPE-01 cleanup station is designed for sample preparation in trace analysis of food and environmental samples. By automating the tedious cleanup procedures, SPE-01 helps to increase the sample throughput and improves the quality of analytical results.

1. Features

1.1 Easy operation

SPE-01 uses built-in methods for automatic column cleanup. The method can be easily edited and can be saved for repeated use. The operation of instrument involves only 7 buttons.

Below are typical routine operation procedures:

- Place sample probes in samples
- Place columns and receiving tubes
- Choose/edit method
- Select samples
- Press the start/stop button



The instrument will process samples one by one till all of the samples have been cleaned up. The touch screen LCD makes operation of the instrument easy and fast.

1.2 Full automation

SPE-01 can automatically fulfill the following actions:

- Pre-condition of columns
- Sample loading
- Multi-step elution to remove sample matrix
- Blowing air through the column to dry the sorbent
- Multi-step fraction collection
- Detection and smart handling of column blockage

When the instrument detects a blockage in column, it will automatically reduce the flow rate. Only when the problem cannot be solved by using lower flow rates, the instrument will go to the pause mode. The process can resume after the blockage is removed. It is not necessary to start all over again.

1.3 Small footprint and computer-free operation

The instrument has a small footprint and does not need a computer. The solvent bottles are placed on top of the instrument. The compact design helps to save precious laboratory space. When volatile or toxic solvents (such as hexane, acetone, and petroleum ether) are used in sample preparation, the instrument can be conveniently placed in a fume hood.

1.4 Easy transfer of existing manual methods

Below is an example of methods for SPE-01:

Line #	Action	Flow rate	Volume
1	Elute 2	15	5.0
2	Elute 1	15	10.0
3	Add samp	6	20.0
4	Elute 2	6	5.0
5	Collect 1	6	5.0
6	Elute 3	10	10.0
7	Collect 2	6	10.0

The format is very similar to manual methods. Any manual procedure for column cleanup can be conveniently transferred to an instrument method.

2. Applications

2.1 Column cleanup for analysis of drug and pesticide residues in food samples

Traditional column cleanup uses glass columns packed with silica gel, alumina, or Florisil. Now pre-packed solid phase extraction cartridges are getting popular.

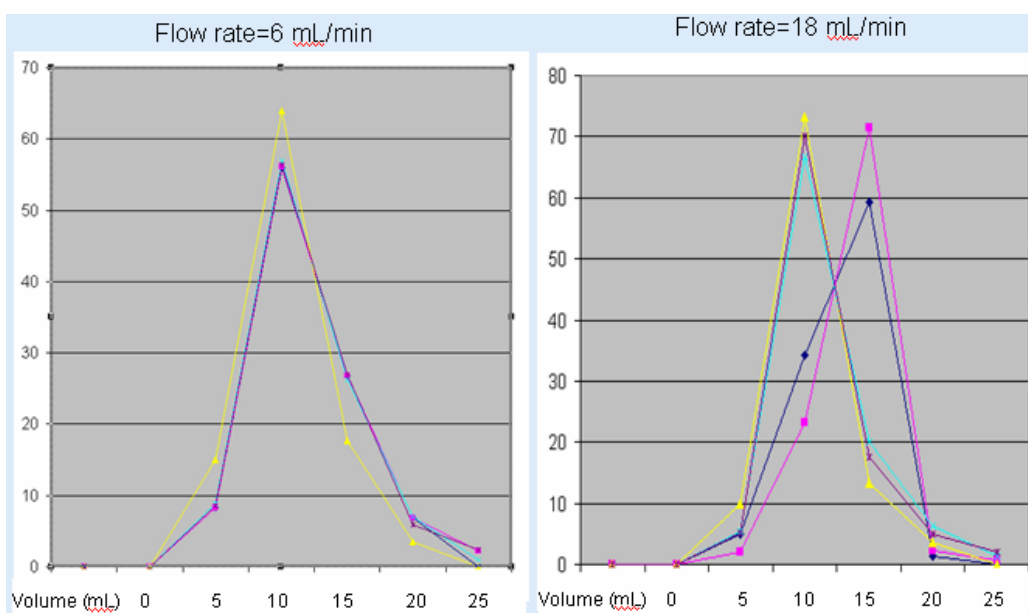
A typical clean up method involves pre-conditioning of column using a strong solvent (such as acetone) followed by a weak solvent (such as hexane). After adding the sample, columns are first eluted with a weak solvent to remove lipids and other low polarity components from sample matrix. The strength of elution solvents can then be increased stepwise. In handling multi-residue analysis, pesticides of different polarity may be collected into two fractions. Existing methods can be easily modified and used for SPE-01 plus automation process.

Since it is hard to control the flow rate and volume of solvents, the repeatability of manual SPE is not satisfactory and is mainly used for simple clean up. SPE-01 plus can control flow rate accurately and helps to improve reproducibility of the analysis. With SPE-01 plus, users can do multi step elution using up to 5 solvents. Therefore, the instrument is very useful for the clean up of complex samples and especially for the simultaneous analysis of multi-residues.

2.2 Accelerated elution (Flash column chromatography)

The flow rate in manual column cleanup is limited by gravity and particle size of the sorbent. In addition to unstable flow rate, the elution cannot be accelerated. In organic synthesis field, column chromatographic purification has seen a drastic improvement after introduction of flash HPLC which uses higher flow rate and sorbent of smaller particles. However this technique is seldom used for sample cleanup in trace analysis due to the lack of suitable automated cleanup instruments.

The performance of the pump in SPE-01 is comparable to the pump used in a flash LC. It can deliver a flow rate up to 20 mL/min. The high output pressure also allows to use smaller particles (10-20 μ m) to improve the column efficiency. Below is an example of its application for pesticide residue cleanup in tea.



Elution pattern of 5 pyrethroid insecticides on column packed with 3 gram florasil (fenpropathrin, cyhalothrin, cypermethrin, denvaterate, deltamethrin).

As shown in the above figures, elution pattern at 18 mL/min is similar to that at 6 mL/min (near the flow rate in manual column cleanup). A much faster elution speed can be achieved in automated column cleanup.

Currently the particle size of packing material for SPE cartridges and column chromatographic cleanup is normally of 40 μ m and above. Although it is known that a smaller particle gives better separation efficiency and reduces elution volume in chromatography, it is not practical in manual operation as the liquid will have problem flowing out. With the introduction of SPE-01, it becomes possible to use columns with smaller particles.

3. Specifications

Sample capacity	6 per batch
Volume of sample	1 to 100 mL
Fraction collection	2 fractions per sample, maximum fraction volume, 50 mL
Material of wetted parts	Teflon, PEEK, Pyrex glass
System control	Micro controller with LCD and keypad
Method	Permanent storage of 3 methods
Method functions	Pre condition, load sample, elution with 5 solvents, blow dry of sorbent, fraction collection.
Pump flow rate	1 to 20 mL/min
Precision of pump	CV < 1.5%
Power supply	24 VDC
Current	< 1 A
Weight	12.5 kg
Dimension	34 x 34 x 45cm (width x depth x height)

4. Ordering Information

Part Number	Description	Price (US\$)
SPE-01-01	Includes SPE-01 mainframe, 24V power supply, collection tray, adapter for 3-mL and 6-mL columns, and user manual.	

SPE-03 4-Channel Cleanup Station

SPE-03 4-channel cleanup station is designed for automatic solid phase extraction of large volume water samples. It has four pumps to handle four samples simultaneously. By providing constant flow rate and well controlled elution procedures, SPE-03 helps to improve quality and efficiency of water analysis and release chemists from tedious sample preparation routines.

1. Features

1.1 Easy operation

SPE-03 uses built-in methods for automatic extraction. The methods can be easily edited and saved for repeated use. The operation of instrument involves only 7 buttons. Below are typical routine operation procedures:

- Place sample inlet probes in samples
- Place columns and receiving containers
- Select method
- Press start/stop button

1.2 Blockage detection and smart handling

The system can detect the blockage and reduce the flow rate accordingly. If blockage still occurs at the minimum flow rate, the instrument will pause and wait for human attendance.

1.3 Built-in air pump for drying of SPE column

If the final analysis is by GC or GC-MS, the collected fraction after SPE cleanup needs concentration. Moisture left in the fraction can affect the concentration process. A drying step is necessary after loading the water sample to SPE column. This is normally achieved by blowing air or nitrogen through the SPE column. SPE-03 has a built-in air pump and thus a gas cylinder is not necessary.

1.4 Small footprint and computer-free operation

The instrument has a very small footprint and does not need a computer. The elution solvents are placed on the top of the instrument. The compact design helps to save precious laboratory space.

1.5 Different flow rate for each elution steps

Different flow rates can be set for column conditioning, sample loading, and elution. Procedures that are not sensitive to flow rate (e.g. conditioning and blow dry) can use higher flow rate to save time.



1.6 Separate collection of water waste and solvent waste

SPE-03 collects water waste and organic solvent waste in different containers. This feature helps to protect our environment and reduce cost in waste treatment.

2. Specifications

Sample capacity	4 per batch
Volume of sample	1 to 4000 mL
Material of wetted parts	Teflon, PEEK, Pyrex glass
System control	Micro controller with LCD and keypad
Method	Permanent storage of three methods
Method functions	Pre condition, load sample, elution with 5 solvents, blow dry of sorbent, fraction collection.
Pump flow rate	1 to 30 mL/min
Pressure limit of pump	6 bar
Pump reproducibility (C.V.%)	<1.5
Power supply	24 VDC
Current	< 1 A
Weight	13 Kg
Dimension (cm)	34 x 34 x 45cm (width x depth x height)

3. Ordering Information

Part Number	Description	Price (US\$)
SPE-03-01	Includes SPE-03 mainframe, 24V power supply, collection tray, sample inlet head with filter, adapter for 3-mL and 6-mL columns, and user manual	

SPE-04 Cleanup Station

SPE-04 cleanup station is designed for automatic cleanup of biological samples. Compared to SPE-01, SPE-04 has smaller sample volume and fraction volume and can process much larger number of samples per batch.

1. Features

1.1 Easy operation

The operation of SPE-04 is similar to SPE-01. It involves only 7 buttons. Below are typical routine operation procedures:

- Select method
- place sample columns and receiving containers on the tray
- Press start/stop button

1.2 Small footprint and computer-free operation

Like other SPE instrument from PromoChrom, SPE-04 has a very small footprint and does not need a computer. The elution solvents are placed on the top of the instrument. The compact design helps to save precious laboratory space.



1.3 Different flow rate for each elution steps

Different flow rates can be set for column conditioning, sample loading, and elution. Procedures that are not sensitive to flow rate (e.g. conditioning and blow dry) can use higher flow rate to save time.

1.4 Automatic needle wash

Sample needle is thoroughly washed before processing each sample. The tubing is also continuously washed to avoid cross contamination.

1.5 Upgradeable to advanced functions

SPE-04 can be upgraded to add online SPE and online derivatization function. It can also add function for auto sample injection for HPLC.

2. Specifications

Sample capacity	18 or 41 per batch
Volume of sample	4 or 20 mL
Fraction collection	2 fractions with maximum volume 50 mL or 4 mL
Material of wetted parts	Teflon, PEEK, Pyrex glass
System control	Micro controller with LCD and keypad
Method	Permanent storage of three methods
Method functions	Pre condition, load sample, elution with 5 solvents, blow dry of sorbent, fraction collection.
Pump flow rate	1 to 30 mL/min
Pressure limit of pump	6 bar
Pump reproducibility (C.V.%)	<1.5
Power supply	24 VDC
Current	< 1 A
Weight	7 Kg
Dimension (cm)	34 x 42 x 35 cm (width x depth x height)

3. Ordering Information

Part Number	Description	Price (US\$)
SPE-04-01	Includes SPE-04 mainframe, 24V power supply, and user manual	

SPE-05 multi function SPE

SPE-05 multi function SPE is a flexible and versatile platform for automatic sample preparation. It can perform multiple tasks: offline SPE, online SPE, normal sample injection, and online derivatization with controlled temperature.

1. Features

1.1 Offline SPE

It can work like above described SPE-04 for offline column cleanup and fraction collection. When working in offline mode, computer is not necessary. Users can set up the instrument quickly using the 7 buttons.

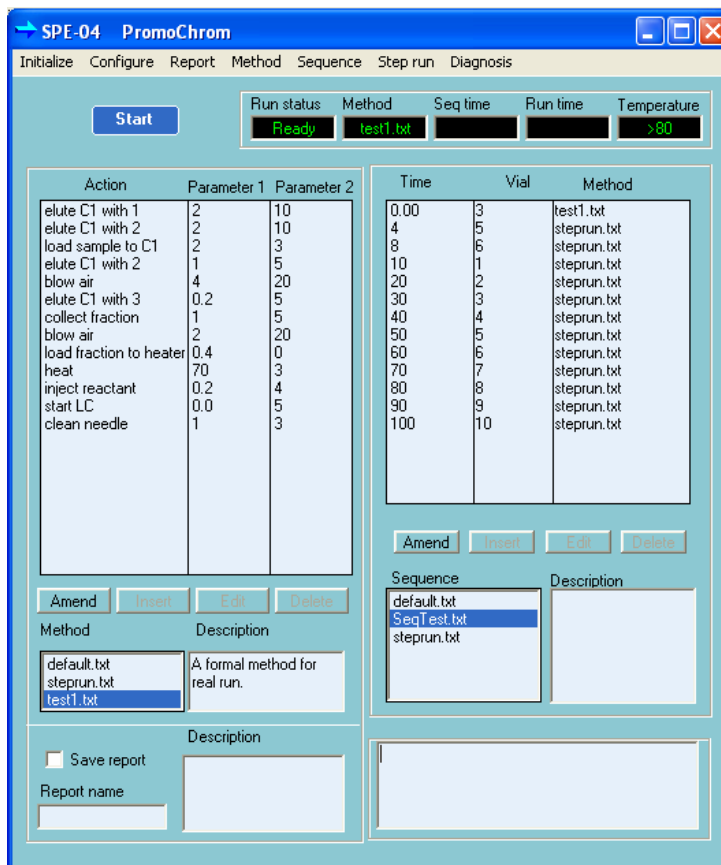
1.2 Online SPE

In online mode, the collected fraction is directly injected into an HPLC or LC-MS for final determination. The control software for online SPE is user friendly and is compatible with most HPLC software.

The software uses methods and sequences for the automation. It has similar structure as Agilent Chemstation. Users of HPLC can easily understand the SPE-04 software.

The software can perform overlapped injection. When HPLC is performing an HPLC run, SPE-04 can start processing the next sample.

In online mode, SPE-05 can perform derivatization under controlled temperature. This function is very useful for analysis of amino acids, hormones, and some pesticides.

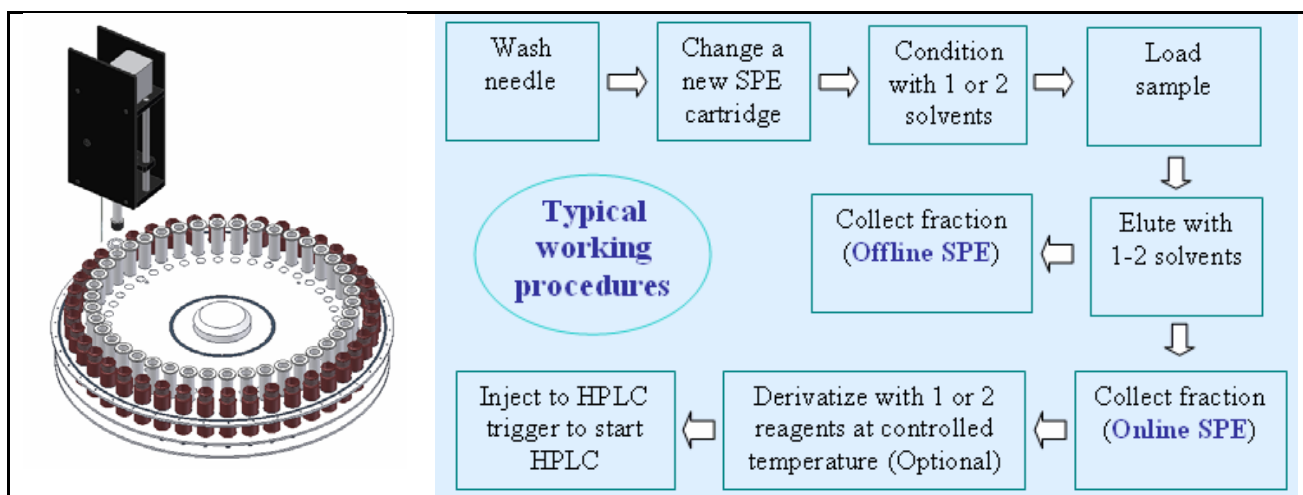


1.3 Direct sample injection

SPE-05 can work as an auto sampler. Therefore, the HPLC does not need to have another sample introduction device. This feature can reduce the cost of an HPLC system considerably.

2. Working principle

The following diagrams describe the structure and typical working procedures of the 3-in-1 model.

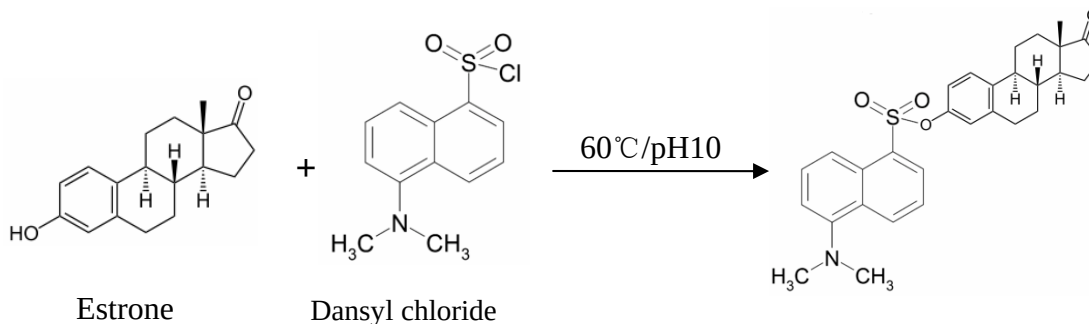


The plunger for SPE column can seal the column well. It can work with SPE columns from most suppliers. There is no need for a special cap or adapter.

3. Application example

Direct analysis of hormone in plasma sample:

- 1) Dilute plasma sample with 1% phosphoric acid at 1:1 ratio
- 2) Precondition a 3-mL/500-mg C18 SPE column with 2 mL methanol followed by 2 mL water
- 3) Load 2 mL sample and wash with 4 mL water+methanol (80:20)
- 4) Wash SPE column using methanol and collect 1 mL fraction



- 5) Derivatize the fraction with dansyl chloride at 60 °C
- 6) HPLC analysis using a PCTsil C18 column and UV or fluorescence detection.

4. Specifications

Sample capacity	18 or 41 per batch
Maximum sample volume	4 or 20 mL
Material of wetted parts	Teflon, PEEK, Pyrex glass
System control	Computer or micro controller with LCD and keypad
Method functions	Pre condition, load sample, elution with 5 solvents, blow dry of sorbent, mix fraction with 1 or 2 derivatization reagents, heat up to 80 °C.
Temperature for derivatization	Ambient to 80 °C
Type of derivatization reagent	2
Pump flow rate	1 to 30 mL/min
Pressure limit of pump	6 bar
Pump reproducibility (C.V.%)	<1.5
Power supply	24 VDC
Current	< 1 A
Weight	7 Kg
Dimension (cm)	34 x 42 x 35 cm (width x depth x height)

5. Ordering Information

Part Number	Description	Price (US\$)
SPE-05-01	Includes SPE-05 mainframe, sample injection module for HPLC, control software, remote cable for HPLC, 24V power supply, and user manual.	
SPE-05-02	Includes SPE-05 mainframe, sample injection function for HPLC, online derivatization module, and control software, remote cable for HPLC, 24V power supply, and user manual.	

Online SPE for Direct Analysis of Water Samples

Online SPE is for direct analysis of water samples. It combines sample extraction and LC or LC-MS analysis.

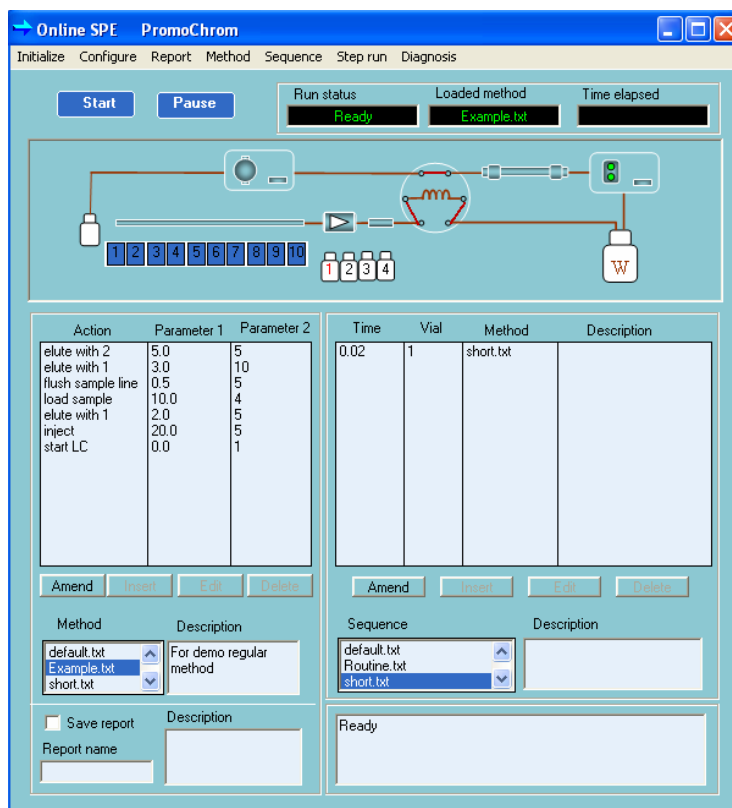
1. Working principle

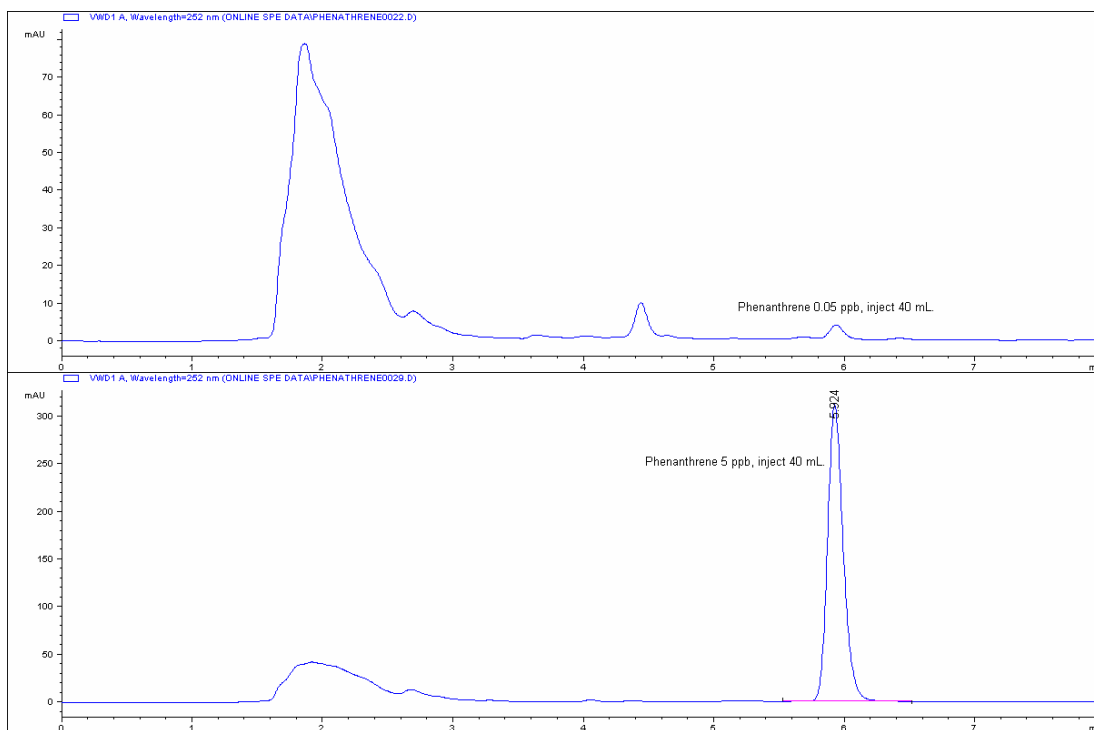
The online SPE uses valves and a syringe pump to transfer sample to SPE column and then to the HPLC system.

The control software looks after the detailed valve switches. Users only need to select the necessary actions. Such as “load sample”, “add reagent 1”, “inject”, “start LC”, etc. The device uses remote signal to trigger start of HPLC. While the HPLC is running a sample, online SPE can carry out extraction of next sample. The overlapped introduction saves the time for sample preparation.

2. Applications

Below is an example for direct analysis of polycyclic aromatic hydrocarbons (PAH) in tap water at ppt level. A 40-mL tap water is analyzed directly. Since the whole portion of the sample is injected to the analytical column, the detection limit can go down to 5 ppt without using fluorescence detection. By using the overlapped injection feature, the processing time for one sample is only 15 minutes.





Direct analysis of phenanthrene in tap water at 5 ppb and 50 ppt level using online SPE coupled with HPLC. SPE column, TrapN; analytical column PromSil C18; sample volume, 40 mL; flow rate for sample loading, 6 mL/min; detection wavelength, 252 nm.

In an offline approach, normally 500 to 1000 mL water need to be extracted. Further concentration and solvent exchange are followed before the instrument analysis. Only a very small portion of the concentrated sample is injected to the HPLC. To achieve similar detection limit of online SPE, 4-liters of water need to be extracted. The processing time for one sample is above 1 hour.

Another advantage of online SPE over offline SPE is its good reproducibility. Since online SPE involves fewer procedures than the offline approach and all these procedures are controlled by instrument, the chance of error is much less. Even at 0.05 ppb level, the %RSD is only 2.5 (n=3).

Therefore, if the pollutant can be analyzed by HPLC, the online approach should be used.

The key for a successful application of online SPE is the selection of a suitable SPE column and the analytical column. To simplify the method development, PromoChrom provides two method kits with well matched SPE column and the analytical column. They also include the method parameters for most common analysis. By slightly adjusting the parameters, users can easily development their own methods.

3. Specifications

Number of samples	10
Volume of sample (mL)	1-100
Number of elution solvents	4
Pump reproducibility (C.V.%)	< 1.5
Pressure limit of pump	10 bar
Material of wetted parts	Stainless steel, Teflon, PEEK, special glass
System control	Software via computer
Power supply	24 VDC
Current	< 1 A
Weight	7.0 Kg
Dimension	26 x 26 x 37 cm (width x depth x height)

4. Ordering Information

Part Number	Description	Price (US\$)
LC-03-01	Online SPE	
LC-03-03	Method kit for compounds of low polarity (Include 5 TrapN SPE column, one analytical column, and methods)	
LC-03-04	Method kit for compounds of high polarity (Include 5 TrapP SPE column, one analytical column, and methods)	

LC-05 Auto Injector

LC-05 auto injector is for automatic introduction of samples from a fixed source. Typical applications are online monitoring. It enables a normal HPLC to fulfill tasks that cannot be done using a HPLC auto sampler.

By adding a valve based fraction collector, large scale purification can be achieved using an analytical scale HPLC.

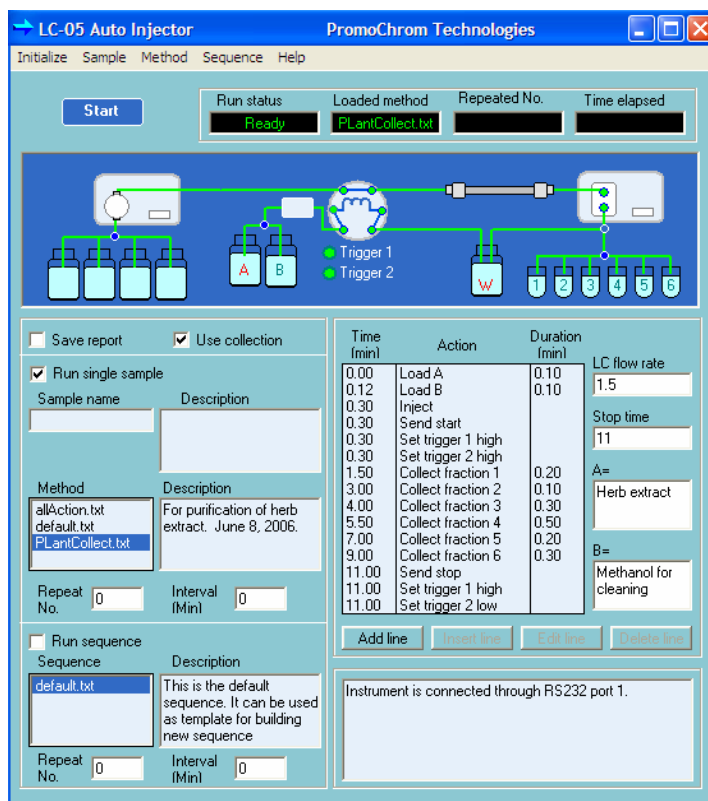
LC-05 Auto Injector is designed to work with any type of HPLC instruments. Its versatile interface makes the integration easy and fast. The user friendly and powerful software provides highly automatic and reliable control.



1. Working principle

The injector consists of a divert valve, a load pump, a high-pressure switch valve, and the control software. The divert valve makes selection between two sources for injection. For on-line analysis, one source can be the sample and the other source can be the calibration solution. In case of repeated injection for large scale purification, the two sources can be two samples. The load pump is used to deliver sample to the sample loop. The pump can deliver very accurate volume, since the volume per cycle is fixed and the number of cycles is controlled by the software. The switch valve is used to connect the HPLC pump to the sample loop for injection.

The diagram of the software not only demonstrates the working principle but also serves as a graphical user interface. The software provides two types of control for the injector. The components of the injector can be directly switched by clicking on the relevant icons in the diagram. A second click can stop the pump. For a more automatic control, methods or sequence can be used. The software monitors the status of the injector and the HPLC regularly. The status is reflected in the diagram for easy observation. For example, when the switch



The user interface of the control software

valve changes from inject position to load position; its connection diagram is updated for the new position. If the switch valve goes out of control, a warning message and help tips will be given in the notice panel. The analysis will be paused. The injector will also monitor the status of HPLC through a remote cable. It will start a run only when the HPLC is ready for analysis.

2. Specifications

Injection valve	
Material of wetted parts	Stainless steel, Valcon H (carbon fiber reinforced PTFE)
Pressure limit	5,000 psi (liquid)
Switch time	<120 ms
Sample loop	Specify when order (5 uL to 10 mL)
Loading pump	
Material of wetted parts	Teflon and PEEK
Flow rate	4 mL/min
Accuracy (C.V.%)	2
Repeatability (C.V.%)	1
Maximum outlet pressure	5 psi (0.35 bar)
System	
Communication with PC	RS232
Power supply	24 VDC
Current	< 1 A
Remote interface	TTL signal or contact closure for input; TTL output
Weight	2 Kg
Dimension	25 x 23 x 11.5 cm (width x depth x height)

3. Ordering Information

Part Number	Description	Price (US\$)
LC-05A	LC-05 Auto injector	
LC-05A-01	LC-05 Auto injector with fraction collector	

LC-05 Plus Online Injector

LC-05 Plus online injector is designed for process monitoring and optimization in pharmaceutical and chemical industries. The online injector works with an Agilent 1200 HPLC for online monitoring of reaction progress. It provides a more reliable control on the product quality and helps to improve the production yields by providing a timely harvest indication.



1. Working principle

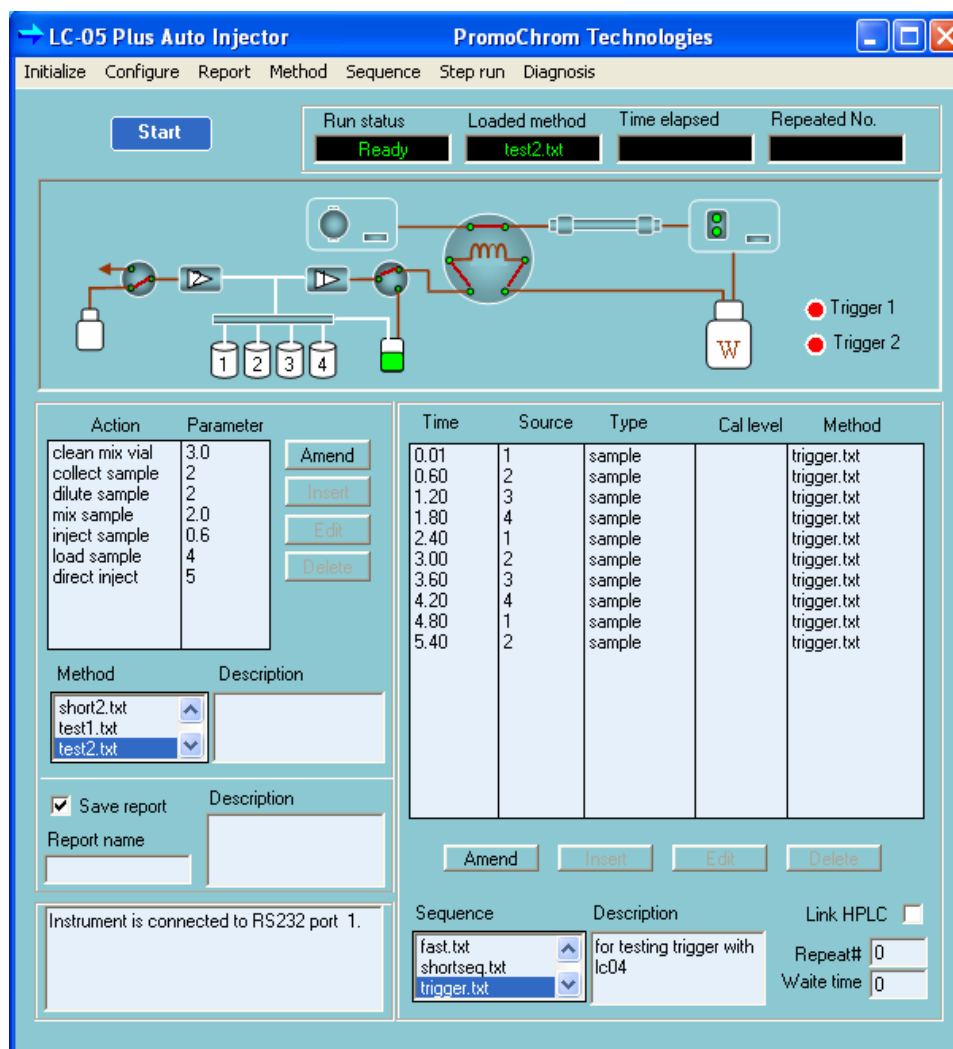
A typical working cycle includes following steps:

- 1) Collect and filter a sample from a site (a reaction vessel or a calibration standard).
- 2) Dilute the sample to make the media compatible with the HPLC mobile phase and the concentration suitable for the HPLC detector.
- 3) Load the sample to the loop of the injection valve.
- 4) Export the sample information (such as sample source, type, collection time, and data file name) to the Chemstation sequence table.
- 5) Check the status of the HPLC. Start HPLC analysis when the HPLC is ready.
- 6) Clean the dilution vial and the sample line.

All the above procedures are carried out automatically using methods or sequence. Users do not need to know the real valve and pump switches.

The integration of the online injector with Agilent HPLC is based on dynamic data exchange. There are no cables involved. The injector also provides an injection port to allow manual introduction of calibration standard for HPLC calibration.

The software monitors the status of the injector and the HPLC regularly. The status is reflected in the diagram for easy observation. For example, when the switch valve changes from inject position to load position; its connection diagram is updated for the new position. If the switch valve goes out of control, a warning message and help tips will be given in the notice panel. The analysis will be paused. The injector will also monitor the status of HPLC through a remote cable. It will start a run only when the HPLC is ready for analysis.



The user interface of the control software

2. Ordering Information

Part Number	Description	Price (US\$)
LC-05-01	LC-05 plus online injector (4 sampling points)	
LC-05-02	LC-05 plus online injector (1 sampling points)	

LC-051 Sample Collector

LC-051 online sample collector can collect samples from up to 4 sites. The fraction collection is based on stream selection valves and can have up to 18 fractions. Since the system does not use XY motion control, the receiving containers can have any shape and volume.



1. Features

The most outstanding feature of the online sampler is its computer free operation. It saves space and cost of a computer. It also enables the device to be placed near the sampling site.

The device can store two methods and a sequence for automatic operation. Although the online sampler involves two pumps and many valves, the commands of a method is simple, such as “collect”, “dilute”, etc. The device will look after the operation of the relevant pumps and valves according to the method command.

The online sampler can work as a control master and use the sequence to decide sampling location, collection time, and the collection position. It can also work as a slave and carry out sample collection at the request from other devices (such as the reaction vessel controller or a pH sensor). The communication with other devices is through two ports with 2 digital outputs and 4 digital inputs. The integration is easy and fast.

2. Ordering Information

Part Number	Description	Price (US\$)
LC-051-01	LC-051sample collector (4 sampling point)	
LC-051-02	LC-051 sample collector (1 sampling point)	

Online Degassers

An on-line degasser helps to reduce detection noise and improve the retention time reproducibility. When a low pressure gradient pump is used, an on-line degasser is required for a smooth operation. PromoChrom offers 6 types of degassers to meet the needs from analytical scale to preparative scale HPLC.

The degassers use a smart micro-controller to control the vacuum system and to ensure durable and trouble free operation. The LCD shows the real-time vacuum level. It gives a clear indication of the working status of the degasser.



1. Feature of online degassers

- 1) Real-time display of vacuum level to ensure proper operation
- 2) Separate degassing chamber for each channel to avoid cross contamination
- 3) Output signal for error monitoring
- 4) Inert wetting material: PTFE, ETFE, PPS, Chemraz
- 5) Small foot print for easy accommodation

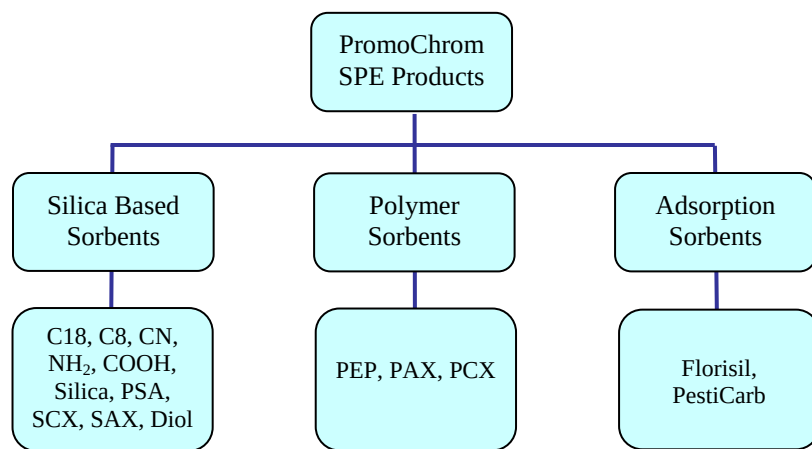
2. Ordering Information

Part Number	Description	Price (US\$)
DG-052	Degasser for analytical HPLC Two channels; maximum flow rate, 5 mL/min.	
DG-054	Degasser for analytical HPLC Four channels; maximum flow rate 5 mL/min.	
DG-102	Degasser for semi-preparative HPLC Two channels; maximum flow rate, 10 mL/min.	
DG-104	Degasser for semi-preparative HPLC Four channels; maximum flow rate 10 mL/min.	
DG-501	Degasser for preparative HPLC One channel; maximum flow rate, 50 mL/min.	
DG-502	Degasser for preparative HPLC Two channels; maximum flow rate 50 mL/min.	

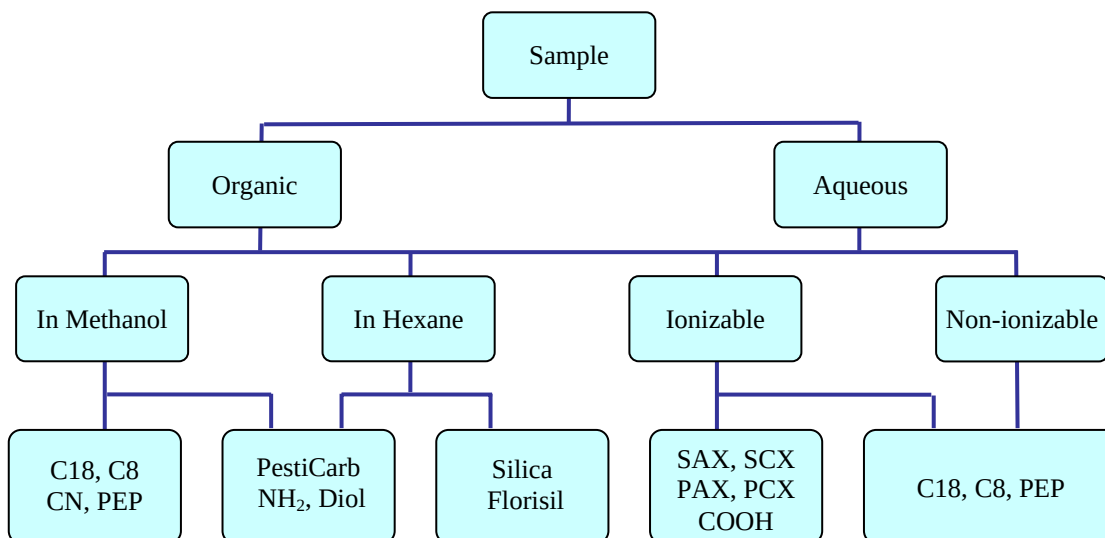
Solid Phase Extraction Cartridges

Solid phase extraction (SPE) is the most powerful technique currently available for rapid, selective sample preparation. The versatility of SPE allows it to be used for a number of purposes, such as purification, fractionation, trace enrichment, solvent exchange, desalting, and derivatization.

PromoChrom Technologies provides three major types of SPE sorbents.



1. Selection Guide – PromoChrom SPE Cartridges



2. Order Information – PromSil SPE Cartridges

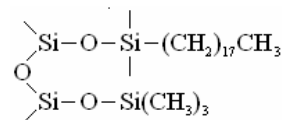
PromSil Silica Based Sorbents – C18, C8, CN, PSA, SAX, SCX, COOH, & PRS

Made of high quality and pure silica particles
Sorbent surface is specially modified to ensure high
sample recovery and good reproducibility

Average particle diameter: 45 µm
Average Pore Size: 60 Å
Pore Volume: 0.8 cm³/g
Specific Surface Area: 480 m²/g

C18 (Endcapped) SPE Cartridge Order Information:

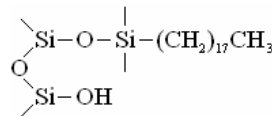
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	18-010-1-C	108
200 mg, 3 mL	50	18-020-3-C	75
500 mg, 3 mL	50	18-050-3-C	88
500 mg, 6 mL	30	18-050-6-C	58
1000 mg, 6 mL	30	18-100-6-C	85



Structure of C18 silane and trimethyl silyl endcapping group, covalently bonded to the surface of a silica particle.

ODS C18-N (Non-endcapped) SPE Cartridge Order Information:

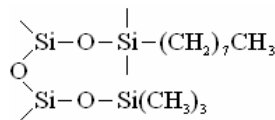
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	18-010-1-N	108
200 mg, 3 mL	50	18-020-3-N	75
500 mg, 3 mL	50	18-050-3-N	88
500 mg, 6 mL	30	18-050-6-N	58
1000 mg, 6 mL	30	18-100-6-N	85



Structure of C18 octadecylsilane (ODS), covalently bonded to the surface of a silica particle.

C8 SPE Cartridge Order Information:

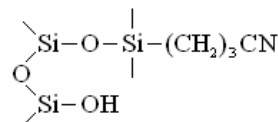
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	08-010-1	108
200 mg, 3 mL	50	08-020-3	75
500 mg, 3 mL	50	08-050-3	88
500 mg, 6 mL	30	08-050-6	58
1000 mg, 6 mL	30	08-100-6	85



Structure of C8 octyl silane and trimethyl silyl endcapping group, covalently bonded to the surface of a silica particle.

CN Cyanopropyl SPE Cartridge Order Information:

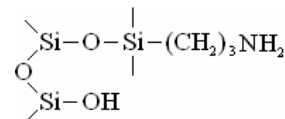
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	CN-010-1	108
200 mg, 3 mL	50	CN-020-3	88
500 mg, 3 mL	50	CN-050-3	108
500 mg, 6 mL	30	CN-050-6	78
1000 mg, 6 mL	30	CN-100-6	118



Structure of cyano silane, covalently bonded to the surface of a silica particle.

NH₂ Aminopropyl SPE Cartridge Order Information:

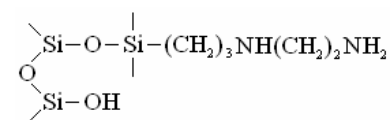
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	NH-010-1	108
200 mg, 3 mL	50	NH-020-3	75
500 mg, 3 mL	50	NH-050-3	88
500 mg, 6 mL	30	NH-050-6	58
1000 mg, 6 mL	30	NH-100-6	85



Structure of amino (NH₂) silane, covalently bonded to the surface of a silica particle.

PSA (N-aminoethyl) Aminopropyl SPE Cartridge Order Information:

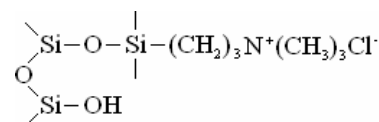
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	PA-010-1	108
200 mg, 3 mL	50	PA-020-3	75
500 mg, 3 mL	50	PA-050-3	88
500 mg, 6 mL	30	PA-050-6	58
1000 mg, 6 mL	30	PA-100-6	85



Structure of PSA silane, covalently bonded to the surface of a silica particle.

SAX (Strong Anion Exchanger) SPE Cartridge Order Information:

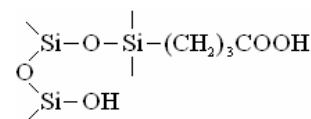
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	SA-010-1	108
200 mg, 3 mL	50	SA-020-3	88
500 mg, 3 mL	50	SA-050-3	108
500 mg, 6 mL	30	SA-050-6	78
1000 mg, 6 mL	30	SA-100-6	118



Structure of SAX silane, covalently bonded to the surface of a silica particle.

COOH (Weak Cation Exchanger) SPE Cartridge Order Information:

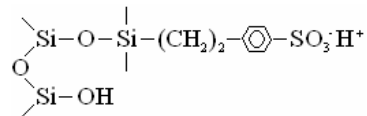
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	CH-010-1	108
200 mg, 3 mL	50	CH-020-3	88
500 mg, 3 mL	50	CH-050-3	108
500 mg, 6 mL	30	CH-050-6	78
1000 mg, 6 mL	30	CH-100-6	118



Structure of propyl carboxylic acid (COOH) silane, covalently bonded to the surface of a silica particle.

SCX (Strong Cation Exchanger) SPE Cartridge Order Information:

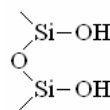
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	SC-010-1	108
200 mg, 3 mL	50	SC-020-3	88
500 mg, 3 mL	50	SC-050-3	108
500 mg, 6 mL	30	SC-050-6	78
1000 mg, 6 mL	30	SC-100-6	118



Structure of SCX silane, covalently bonded to the surface of a silica particle.

Silica SPE Cartridge Order Information:

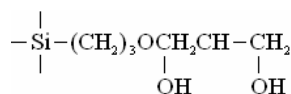
Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	SI-010-1	90
200 mg, 3 mL	50	SI-020-3	68
500 mg, 3 mL	50	SI-050-3	78
500 mg, 6 mL	30	SI-050-6	54
1000 mg, 6 mL	30	SI-100-6	70



Structure of silanol groups on the surface of a silica particle.

Diol SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	DI-010-1	108
200 mg, 3 mL	50	DI-020-3	88
500 mg, 3 mL	50	DI-050-3	108
500 mg, 6 mL	30	DI-050-6	78
1000 mg, 6 mL	30	DI-100-6	118



Structure of diol silane, covalently bonded to the surface of a silica particle.

PromSil Polymer Sorbents – PEP, PAX & PCX

PEP SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
30 mg, 1 mL	100	PE-003-1	138
60 mg, 3 mL	50	PE-006-3	98
100 mg, 3 mL	50	PE-010-3	118
200 mg, 6 mL	30	PE-020-6	108
500 mg, 6 mL	30	PE-050-6	128

Polystyrene/divinylbenzene with vinyl prolidone
Greater capacity than silica based sorbents
Extract both polar and non polar compounds
pH range: 1 - 14
Average particle diameter: 35 µm
Average pore size: 80 Å
Specific surface area: 600 m²/g

Alternative to Oasis HLB

PAX SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
30 mg, 1 mL	100	AX-003-1	138
60 mg, 3 mL	50	AX-006-3	88
100 mg, 3 mL	50	AX-010-3	118
200 mg, 6 mL	30	AX-020-6	108
500 mg, 6 mL	30	AX-050-6	128

Polystyrene/divinylbenzene with strong anion exchange function
Mixed-mode sorbents (reverse phase and ion exchange)
pH range: 0 - 14
Average particle diameter: 40 µm
Average pore size: 70 Å
Specific surface area: 600 m²/g

PCX SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
30 mg, 1 mL	100	CX-003-1	138
60 mg, 3 mL	50	CX-006-3	88
100 mg, 3 mL	50	CX-010-3	118
200 mg, 6 mL	30	CX-020-6	108
500 mg, 6 mL	30	CX-050-6	128

Polystyrene/divinylbenzene with strong cation exchange function
Mixed-mode sorbents (reverse phase and ion exchange)
pH range: 0 - 14
Average particle diameter: 40 µm
Average pore size: 70 Å
Specific surface area: 600 m²/g

PromSil Adsorption Sorbents – PestiCarb and Florisil

PestiCarb SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	PC-010-1	299
200 mg, 3 mL	50	PC-020-3	168
500 mg, 3 mL	50	PC-050-3	168
500 mg, 6 mL	30	PC-050-6	158
1000 mg, 6 mL	30	PC-100-6	178

Graphitized Carbon
Average particle size: 120~400 mesh
Specially for sample cleanup in pesticide residue analysis

Similar to Supelco Envicarb

Florisil (Magnesia Silica) SPE Cartridge Order Information:

Description	Tubes/Box	Part Number	Price (US\$)
100 mg, 1 mL	100	FS-010-1	90
200 mg, 3 mL	50	FS-020-3	68
500 mg, 3 mL	50	FS-050-3	78
500 mg, 6 mL	30	FS-050-6	54
1000 mg, 6 mL	30	FS-100-6	70

Synthetic Magnesia-Silica Adsorbent
Average particle diameter: 45-60 µm
Average pore size: 80 Å
Specific surface area: 290 m²/g
Specially for sample cleanup in pesticide residue analysis

Terms and Conditions

Price

Prices in this catalog are for reference only and may change without notice. The prices do not include tax and costs on shipping and handling. Please ask PromoChrom or an authorized distributor for a quotation before placing your order.

Design Changes

Due to continuing improvements in design, some items may differ slightly from the descriptions and photographs. Specifications are subject to change without notice.

Warranties

The warranty period for instruments is one year. If notice of defects is received within the warranty period, PromoChrom shall, at its option, either repair or replace the defective products. If PromoChrom is unable to repair or replace the defective products within a reasonable time, buyers shall receive refund of the purchase price upon return of the products. The warranty for defects is limited to the purchase price of the product. In no event shall PromoChrom Technologies be liable for incidental or consequential damages in connection with the furnishing, performance, or use of the products.

PC

Tech



Instrument

Brochure



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SPE-01 Cleanup Station

SPE-01 cleanup station is designed for sample preparation in trace analysis of food and environmental samples. By automating the tedious cleanup procedures, SPE-01 helps to increase the sample throughput and improves the quality of analytical results.

The instrument can handle up to 6 samples per batch without attendance. Up to 5 solvents can be used for column conditioning and multi step elution. Two fractions can be collected for each sample. These features make SPE-1 an ideal tool for sample preparation in multi residue analysis.



1. Features

1.1 Easy operation

SPE-01 uses built-in methods for automatic column cleanup. The method can be easily edited and can be saved for repeated use. The operation of instrument involves only 7 buttons. Typical routine operation procedures:

- Place sample inlet probe in samples,
- Place columns and receiving containers,
- Assign positions for column and fraction collection,
- Press the start/stop button.



The instrument will process the samples one by one till all the samples have been cleaned up.

1.2 Full automation

SPE-01 uses methods and sequence to automate all the procedures for the cleanup. A typical method will first condition the column, and then add sample from the loop to the column. Several steps of elution using different solvents are followed and target fractions are collected for instrumental determination. The instruments can store up to 4 methods for handling

different samples or for cleaning system to avoid cross contamination.

In case the previous step in sample preparation is slow, users can load one sample and start the cleanup first. When the second sample is ready for column cleanup, the instrument can be paused. After adding the second sample, the cleanup will resume.

1.3 Small footprint and computer-free operation

The instrument has a very small footprint and does not need computer. It helps to save precious laboratory space. When volatile or toxic solvents (such as hexane, acetone, and petroleum ether) are used in sample preparation, the instrument can be conveniently place in a fume hood.

1.4 Robust and flexible design

SPE-01 uses valves for liquid transfer and fraction collection. It does not involve complex XYZ motion control. Only moving parts are the pump plunger and the valve rotors. It helps to lower the cost of the device and make the device very reliable.

It is flexible in selection of columns and receiving containers. Both traditional chromatographic columns and SPE cartridges can be used. The receiving containers can have different shape and volume (such as flasks for rotary evaporator). It is convenient the following sample treatment. The volume for samples, elution solvents and fraction collection can be 0.1 to 1000 mL. This feature gives it a very wide application range.

The system has an over pressure warning function. In case the columns are blocked or the flow rate is too high, the process will pause. It can be resumed after the cause has been removed.

2. Applications

2.1 Column cleanup for analysis of pesticide residues and drugs in food samples

Traditional column chromatographic cleanup for food samples uses glass columns packed with silica gel, alumina, or Florisil. Now pre packed solid phase extraction cartridges are getting popular.

SPE-01 can accommodate both columns of traditional size and the small SPE cartridges. It provides elution using up to 5 solvents. A typical method of SPE-01 involves pre conditioning of column using a strong solvent (such as acetone) followed by a weak solvent (such as hexane). After adding the sample, columns are first eluted with a weak solvent to remove lipids and other low polarity components from sample matrix. The strength of elution solvents can be increased stepwise. In handling multi residue analysis, pesticides of different polarity may be collected into two fractions.

2.2 Solid phase extraction of water samples

Solid phase extraction is used for cleanup and enrichment of water samples for analysis of semi volatile organic pollutants. In most cases, water is drawn through the SPE cartridge by a vacuum pump. The flow is not stable. During the extraction process, the flow can decrease gradually or even stop due to accumulation of small particles and natural polymers (such as humic acids) in the sorbent bed. Frequent attendance is necessary. The unstable flow rate during sample addition and elution also affects the reproducibility of the analytical results.

SPE-01 uses a metering pump to deliver the sample through the SPE cartridge. It is faster and stable. A stable flow rate helps to improve reproducibility of the analysis.

The operation of SPE-01 is simple. The instrument will draw the sample to SPE cartridge according pre defined volume. All the necessary procedures (preconditioning, adding sample, air drying of sorbent bed prior to elution, elution, and collection) are carried out automatically for up to 6 water samples. There is no need of attendance during the sample preparation.

2.3 Analysis of drugs in biological samples

Solid phase extraction is used to remove proteins and lipids from biological samples (plasma and urine) prior to determination by HPLC or LC-MS. Many available automatic SPE systems are designed for such application. They use syringe to take an aliquot from each sample and add it to the SPE cartridge.

A problem with their design is the possibility of drying out of the sorbent bed during sample addition and elution. It may affect recovery and the efficiency of cleanup. Although cartridges that are tolerant to drying out are available, they are more expensive than normal silica based cartridges.

The design of SPE-01 can overcome the drying out problem as the liquid path is closed when there is no liquid flow. Another advantage of SPE-01 is its lower cost compared to other automatic SPE instruments. Several SPE-01 may be used together when higher sample throughput is required.

2.4 Regeneration of used SPE cartridges

Sometimes used SPE cartridges are regenerated for repeated use to reduce the cost. SPE-01 can use up to 4 elution solvents and the flow rate can go up to 16 mL/min. It is very convenient for fast regeneration of the cartridges. One method may be used specially for cartridge regeneration.

3. Specifications

Sample capacity	6 per batch
Volume of sample	0.1 to 1000 mL
Material of wetted parts	Stainless steel, Teflon, PEEK
System control	Micro controller with panel key pad and LCD as interface
Method	Permanent storage of four methods
Pump flow rate	up to 16 mL/min
Pressure limit of pump	6 bar
Power supply	24 VDC
Current	< 1 A
Weight	8 Kg
Dimension	30 x 36 x 45 cm (width x depth x height)

4. Ordering Information

Part Number	Description	
SPE-01-01	SPE cleanup station with a pump of 6-bar pressure limit	

LC-04SP Valve System

LC-04SP valve system provides a versatile platform for building valve based solutions. It can have up to 4 valves. Each valve can be a 2-position/6-port valve, a 2-position/8-port valve, a 2-position/10-port valve, a 6-position stream selection valve, or a 10-position stream selection valve.

The most outstanding feature of LC-04SP is its editable valve diagram. The software provides a drawing tool box. Users can design and edit the valve diagram according to their applications and the real valve connections. The software will memorize the diagram.

The other special feature of LC-04SP is its flexibility. Users can choose the number and type of valves according to their needs and can add more valves later.

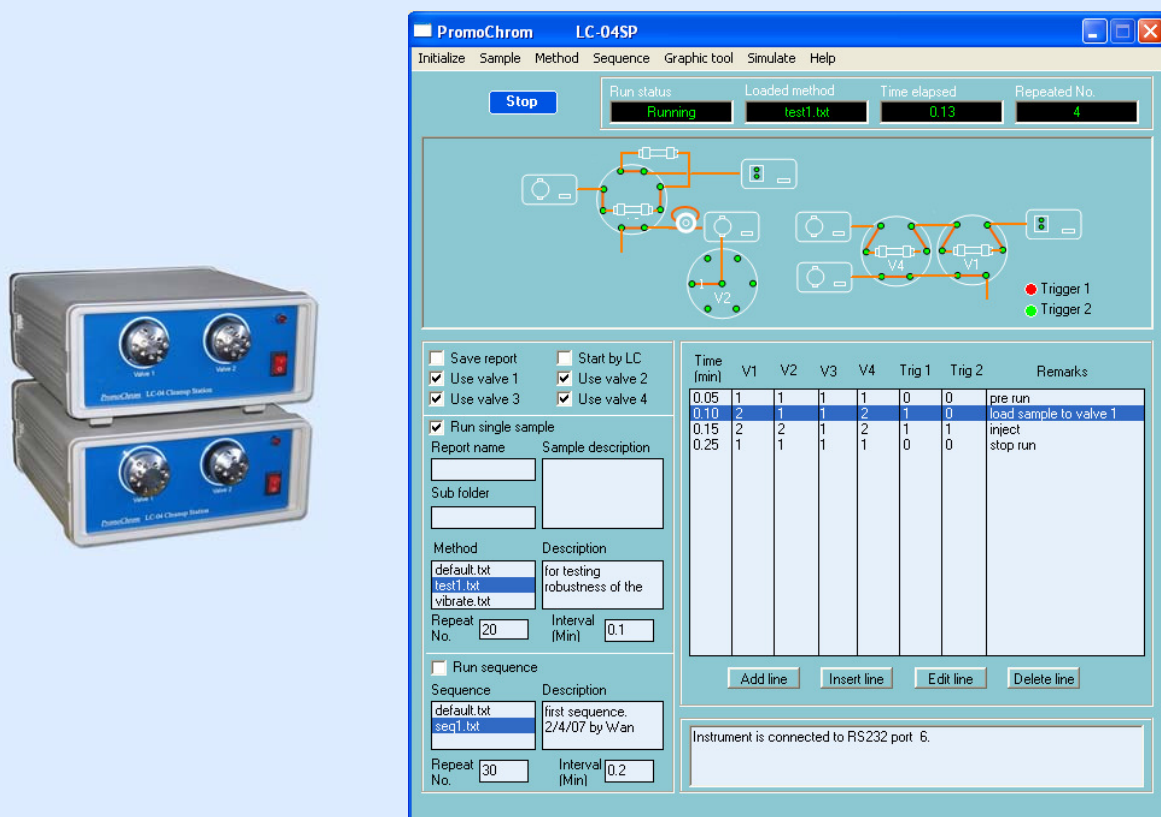


Figure 1. LC-04SP and its control software

1. Instrument Hardware

LC-04SP can have one or two modules and each module has two valves. Figure 2 shows how the devices are connected. It communicates with computer through a RS-232 port or a USB port using a RS232 converter. The second module communicates with computer through the first module using a Y-cable. Each module has a remote port to obtain start/stop signals from other analytical instruments (such as LC-MS, HPLC, or GC). It also has a trigger port to trigger start and stop of other devices, such as pumps or samplers.

The two modules are identical. They can either work together as a 4-valve system or as two independent devices.

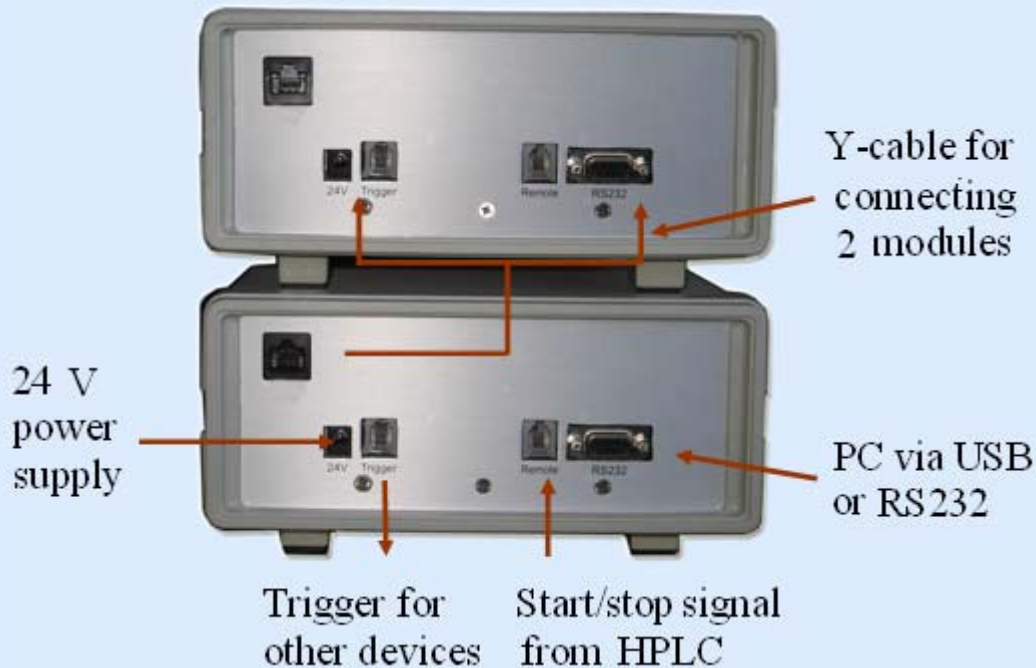


Figure 2. Cable connections for LC-04SP

2. Control Software

When the software is launched, it will search for the device and check the configurations. The software can detect the valve type and the current position of valves. The valve icons in the graphical user interface tell the valve type and the position of the valves.

The valves can be switched directly by clicking at the valve icons or by using a method or sequence. A method includes time programs for each valve and gives explanation for each step. A sequence allows use of different methods in a batch of runs.

The software has a drawing tool box for users to build their own valve diagrams. It helps users to understand the working principle of the valve system. The software will memorize the drawing permanently..

The control software monitors the status of the hardware regularly. When there is an error such as a loosen cable or a valve fails to switch to the correct position, the software will detect it and give warning and help tips.

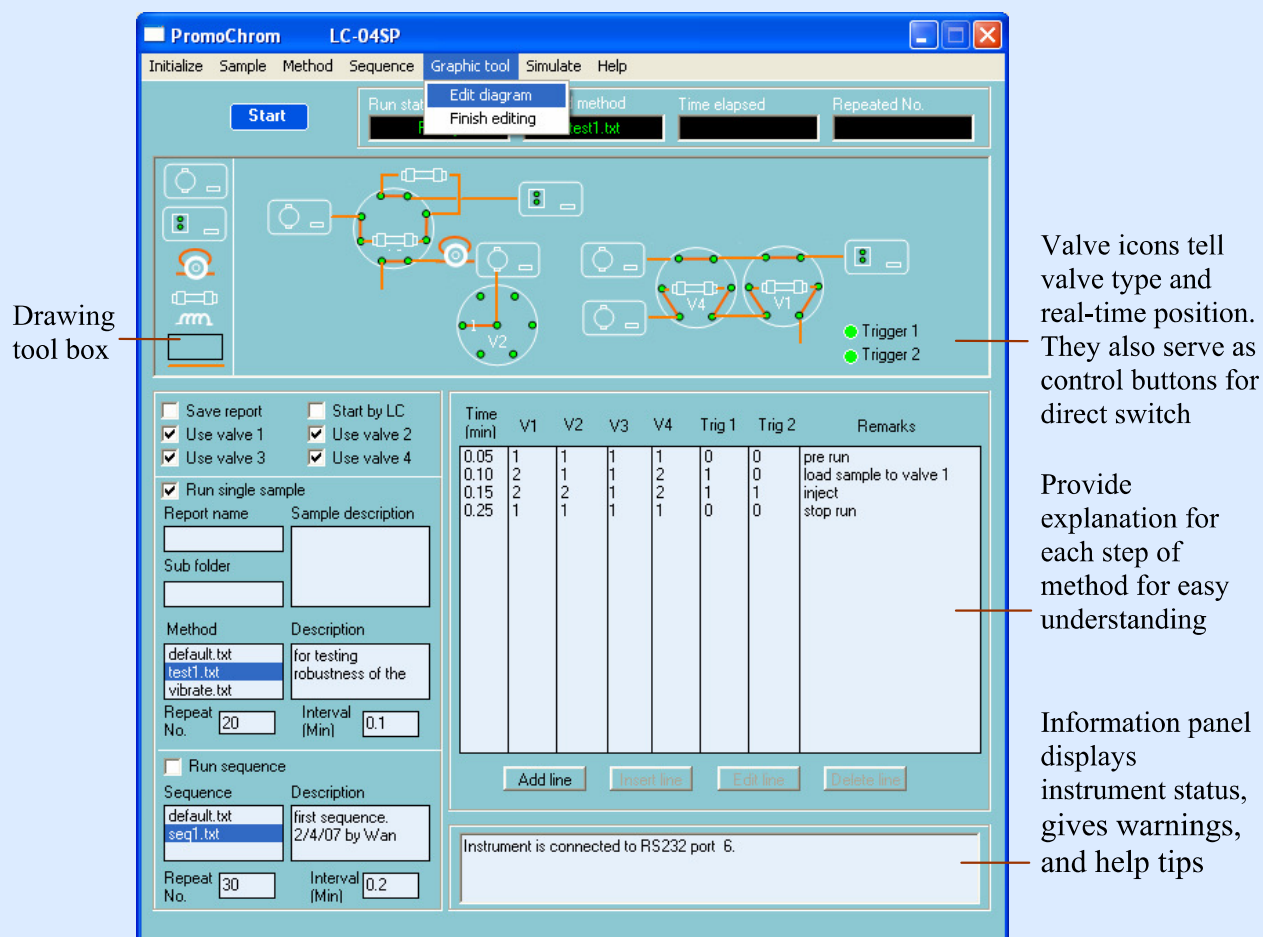


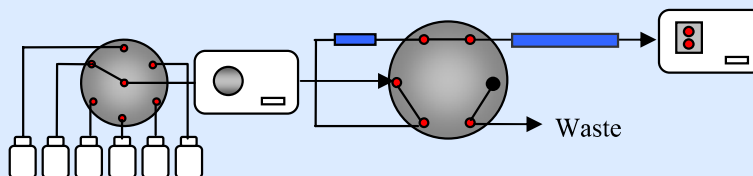
Figure 3. User interface of LC-04SP control software

3. Integration with other instruments

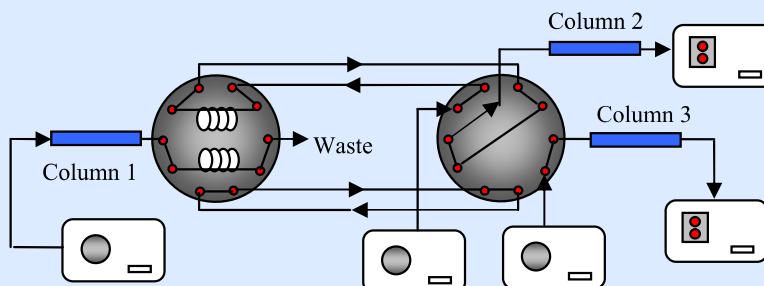
LC-04SP can work with any HPLC and LC-MS that can provide a contact closure or a TTL output. The remote port on LC-04SP can sense the start/stop signals from other instruments. It also has 2 output triggers to trigger start and stop of other devices. This function may be used to start a loading pump for on-line sample cleanup or to trigger the HPLC system for automatic run (it can be very useful when the HPLC does not have an auto sampler and otherwise has to be started manually).

4. Applications

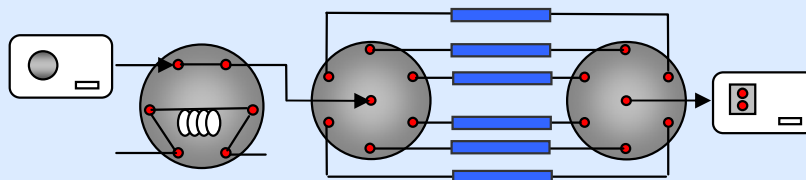
LC-04SP provides a very powerful and versatile platform for building almost any valve based applications. Below are some examples.



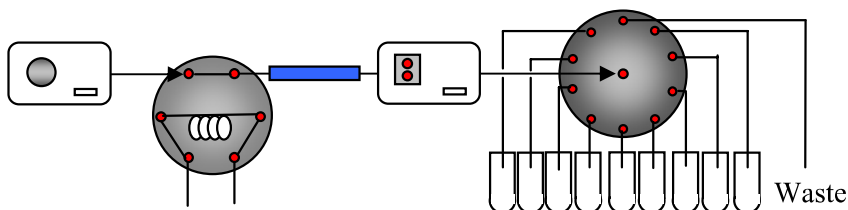
On-line sample cleanup. One isocratic pump looks after both sample cleanup and HPLC elution. A 6-position stream selection valve provides stepwise gradient elution. This is the most economical solution for on-line sample preparation.



Comprehensive 2D HPLC. All fractions from column 1 are separated and analyzed using column 2 and column 3. When column 2 is analyzing one of the fractions from column 1, the following fraction is stored in one of the 2 loops and column 3 is preparing for next analysis. Column 2 and column 3 look after analysis of fractions from column 1 alternately. Column 1 could be a normal phase column. Column 2 and column 3 could be 2 identical reverse phase column.



Automatic method development. Six columns are connected with two 6-position stream selection valves for automatic column selection. One 2-position/6-port valve is used for sample introduction. By controlling the switching time, each time only a portion of the sample in the loop is used for column testing. By using repeated injection, all columns may be tested with only once sample loading. This is very convenient for method development. It saves an auto sampler in this system.



Large scale purification using an analytical scale HPLC. Valve 1 is for sample injection and Valve 2 for fraction collection. A large volume of sample is loaded to the loop on valve 1. LC-04SP will inject a small portion of the sample to the column for each run and will start HPLC for the separation. When one run is completed, the LC-04SP will start the next run automatically until the whole sample in the loop has been processed. The purification can be done without attendance.

5. Specifications

Power supply	24 VDC
Current	< 0.1A when no valve switching; < 0.8 A during valve switching
Number of valves	1 - 4
Type of valves	2-position/6-port, 2-position/8-port, 2-position/10-port 6-position stream selection, 10-position stream selection
Valve head	Cheminert valves from VICI (Valco Instruments)
Valve switching time	< 150 ms for 2-position valves < 200 ms per step for stream selection valves
Dimension	21 x 22.5 x 8.5 cm (width x depth x height)
Computer requirements	PC with Windows operation system

6. Ordering Information

Part Number	Description	
LC04-1-2P6P	First 2-position/6 port valve	
LC04-1-2P8P	First 2-position/8 port valve	
LC04-1-2P10P	First 2-position/10 port valve	
LC04-1-6P	First 6-position stream selection valve	
LC04-1-10P	First 10-position stream selection valve	
LC04-2-2P6P	Add one more 2/6 valve	
LC04-2-2P8P	Add one more 2/8 valve	
LC04-2-2P10P	Add one more 2/10 valve	
LC04-2-6P	Add one more 6 P stream selection valve	
LC04-2-10P	Add one more 10 P stream selection Valve	
LC-04TK	Tubing kit	

LC-04SP Standalone Valve

LC-04SP standalone valve can be controlled by both panel keys and computer. It provides an economical and convenient solution for valve applications.

The product can be controlled by LC-04SP software. The valve types can be 2-position/6-port; 2-position/8-port; 2-position/10-port; 6-position, or 10 position.



1. Features

Easy to use. Using only 6 buttons, users can program the valve switching according to their needs. The method and sequence are permanently stored.

Full automation. The built in method and sequence enable automatic valve switching within a run or between the runs. Computer is not necessary for many applications.

Easy integration with HPLC instruments. LC-04SP standalone valve can synchronize with an HPLC according to its start/stop signals. It can also work as a control master to control the start and stop of an HPLC. The later function is very useful when the HPLC do not have automatic start capability.

2. Applications

- 2.1 Automatic solvent selection for step gradient HPLC
- 2.2 Column switching for on-line sample enrichment and cleanup
- 2.3 Automatic sample injection for up to 10 samples.
- 2.4 Simple fraction collection.

3. Specifications

Power supply	24 VDC
Current	< 0.5 A
Valve switch time	< 150 ms per step
Pressure limit	5,000 PSI (345 bar)
Weight	1 Kg
Dimension	12.5 x 24.0 x 18.0 cm (width x depth x height)

4. Ordering Information

Part Number	Description	
LC04SD	LC-04SP standalone version Includes fittings for the valve ports, a remote cable, and power supply.	
LC04SD-01	LC-04SP standalone valve + PC control Includes fittings for the valve ports, a remote cable, power supply, RS232 cable, USB/RS232 converter, and control software	

LC-05 Auto Injector

LC-05 Auto Injector is for automatic introduction of samples from a fixed source for HPLC analysis. Typical applications are on-line monitoring. It enables a normal HPLC to fulfill tasks that cannot be done using a HPLC auto sampler.

By adding a valve based fraction collector, large scale purification can be achieved using an analytical scale HPLC.



LC-05 Auto Injector is designed to work with any type of HPLC instruments. Its versatile interface makes the integration easy and fast. The user friendly and powerful software provides highly automatic and reliable control.

1. Working Principle

The injector consists of a divert valve, a load pump, a high-pressure switch valve, and the control software. The divert valve makes selection between two sources for injection. For on-line analysis, one source can be the sample and the other source can be the calibration solution. In case of repeated injection for large scale purification, the two sources can be two samples. The load pump is used to deliver sample to the sample loop. The pump can deliver very accurate volume, since the volume per cycle is fixed and the number of cycles is controlled by the software. The switch valve is used to connect the HPLC pump to the sample loop for injection.

Here is a typical working cycle. First the divert valve is connected to the sample and the switch valve is set to “load” position so that the loop is connected to the load pump. Then the load pump delivers certain amount of sample to the loop, while the HPLC pump is flushing the HPLC column. After the loop is filled with the sample, the switch valve connects the HPLC pump to the sample loop. The sample is carried to the HPLC column. At meantime, the injector sends start signal to the HPLC instrument to start the HPLC analysis. The injection can be repeated automatically at any pre set interval. For example, the injector may do analysis once a day. For each day, sample may be injected 3 times and calibration standards 2 times. Such setting can be easily achieved using the sequence table of the software.

The diagram of the software not only demonstrates the working principle but also serves as a graphical user interface. The software provides two types of control for the injector. The components of the injector can be directly switched by clicking on the relevant icons in the diagram. For example, clicking on the icon for the load pump starts pumping. A second click stops the pump. For a more automatic control, methods or sequence can be used.

The software monitors the status of the injector and the HPLC regularly. The status is reflected in the diagram for easy observation. For example, when the switch valve changes from inject position to load position, its connection diagram is updated for the new position. If the switch valve goes out of control, a warning message and help tips will be given in the notice panel. The analysis will be paused. The injector will also monitor the status of HPLC through a remote cable. It will start a run only when the HPLC is ready for analysis.

LC-05 Auto Injector PromoChrom Technologies

Initialize Sample Method Sequence Help

Start Run status: **Ready** Loaded method: **PLantCollect.txt** Repeated No.: Time elapsed:

Graphical user interface

☐ Save report ☒ Use collection

☒ Run single sample

Sample name: Description:

Method: Description:

allAction.txt For purification of herb extract. June 8, 2006.

default.txt

PLantCollect.txt

Repeat No.: 0 Interval (Min): 0

☐ Run sequence

Sequence: Description:

default.txt This is the default sequence. It can be used as template for building new sequence

Repeat No.: 0 Interval (Min): 0

Time (min)	Action	Duration (min)
0.00	Load A	0.10
0.12	Load B	0.10
0.30	Inject	
0.30	Send start	
0.30	Set trigger 1 high	
0.30	Set trigger 2 high	
1.50	Collect fraction 1	0.20
3.00	Collect fraction 2	0.10
4.00	Collect fraction 3	0.30
5.50	Collect fraction 4	0.50
7.00	Collect fraction 5	0.20
9.00	Collect fraction 6	0.30
11.00	Send stop	
11.00	Set trigger 1 high	
11.00	Set trigger 2 low	

LC flow rate: 1.5

Stop time: 11

A=: Herb extract

B=: Methanol for cleaning

Add line Insert line Edit line Delete line

Notice panel

Instrument is connected through RS232 port 1.

The user interface of the control software

2. Applications

2.1 Online analysis

Sometimes it is necessary to trace the progress of a chemical reaction in a reaction vessel. Samples need to be taken at a set interval and analyzed for the concentration of the reactants and the products. The manual sampling part can be tedious and labor intensive. It can also be challenging when the sampling interval is very short. In the above situation, a HPLC auto sampler cannot help with the sampling part. It can only let you collect enough samples and do the instrumental analysis as one batch.

The LC-05 Auto Injector is perfect for handling such situation. It can take sample from the reaction vessel automatically and inject into a HPLC for immediate analysis. It can also inject standard solution for calibration purpose. The HPLC will look after the chromatographic separation and quantitation for each sample. The diagram in the above software interface shows exactly how the instrument can be set up for such application.

In this application, a HPLC sampler is not necessary. The cost of the system is actually reduced since the cost of the LC-05 Auto Injector is lower than an HPLC auto sampler.

2.2 Purification of large volume samples

In large scale purification, the sample volume is large (from hundreds milliliters to several liters for some plant extracts). For most HPLC based purification system, each run can only handle not more than several milliliters of sample. It is limited by the column capacity and the maximum flow rate of the pump. To process such large amount of liquid, hundreds of repeated HPLC runs have to be carried out. Using a manual injector will occupy a full person and can only make use of the instrument for 8 hours per day. On the other hand, using an HPLC auto sampler is also not convenient. The sample needs to be divided into many sample vials as each vial can only hold several milliliters of sample. For many type of auto samplers, it is difficult to inject all the liquid in a vial to the HPLC. There is always some liquid to be left over in the sample vials.

The LC-05 Auto Injector provides a convenient and low cost solution for the purification. The whole sample container can be connected to one source of the LC-05 Auto Injector (the other source may be connected to a solution for washing the system). The injector can make hundreds or thousands of injections automatically. As long as the fraction collector can provide sufficient capacity and the mobile phase can be supplied without interruption, the instrument can work around the clock.

For the fraction collection, there are two options. When the fractions to be collected are simple (e.g. less than 6 fractions and well separated), a valve based collector can be used. This is a very reliable and economical approach. The valve based collector is an optional add on for the injector and can be directly controlled by the software. When the components to be collected are complicated, a collector with more features may be used.

3. Specifications

Injection Valve	
Material of wetted parts	Stainless steel and Valcon H (reinforced carbon fiber composite PTFE lubricated inert engineering polymer)
Pressure limit	5,000 psi (liquid)
Switch time	< 120 ms
Sample loop	Specify when order (5 uL to 10 mL)
Divert Valve	
Material of wetted parts	Teflon and PEEK
Switch time	< 3 ms
Loading Pump	
Material of wetted parts	Teflon and PEEK
Flow rate	4 mL/min
Accuracy	2%
Repeatability	1%
Maximum output pressure	5 psi (0.35 bar)
System	
Communication with PC	RS232
Power supply	24 VDC
Current	< 1A
Remote interface	TTL signal or contact closure for input; TTL output
Weight	2 Kg
Dimension	25 x 23 x 11.5 cm (width x depth x height)

4. Ordering Information

Part Number	Description	
LC05	LC-05 Auto injector	
LC05-01	LC-05 Auto injector with fraction collector	

LC-06 Dosing Pump

LC-06 dosing pump can be used for accurate delivery of reagents or solvents in a laboratory environment. The built-in program and clear display make the automation of the operation fast and easy. Users can use the six panel keys to set the delivery speed, amount, solvent source, and the timing. Its remote interface makes it easy to integrate with other devices. The built-in divert valve can be used to select between two inlets or outlets.



Specifications

Material of wetted parts	Teflon and PEEK
Speed	1 - 120 stroke/min
Stroke volume	20, 40 & 60 μ L
Maximum outlet pressure	5 psi (0.35 bar)
Accuracy	2%
Repeatability	1%
Power supply	24 VDC
Current	< 0.5 A
Communication with PC	RS232
Remote interface	TTL signal or contact closure for input; TTL output
Weight	1 Kg
Dimension	12.5 x 20.5 x 22.5 cm (width x depth x height)

Ordering Information

Part Number	Description)	
LC06	LC-06 dosing pump without PC control	
LC06-01	LC-06 dosing pump with PC control Include control software, RS232 cable, and USB/RS232 converter	

LC-08 Column Selector

LC-08 column selector can make column change with a button press or using built-in method. It eliminates troubles in manually changing HPLC columns and improves efficiency and reliability in analysis.



Features

Easy to use. Using only 6 buttons, users can program the column selector according to their needs. The method and sequence are permanently stored.

Full automation. The built in method and sequence enable automatic column switching within a run or between the runs. Computer is not necessary for many applications.

Easy integration with HPLC instruments. LC-08 column selector can synchronize with an HPLC according to its start/stop signals. It can also work as a control master to control the start and stop of an HPLC. The later function is very useful when the HPLC do not have automatic start capability.

Applications

1. Direct column switch by pressing the up and down buttons. It eliminates all the troubles in manual column change.
2. Use different columns in a batch of analysis.
3. Screen for right columns in method development. Several columns can be tested one by one without attendance.
4. Automatic column regeneration. By adding an HPLC pump only, columns can be regenerated automatically. As the column selector can control the pump, computer and autosampler are not necessary.
5. Simple fraction collection.

Specifications

Power supply	24 VDC
Current	< 0.5 A
Valve switch time	< 150 ms per step
Pressure limit	5,000 psi (345 bar)
Number of column	6
Weight	2 Kg
Dimension	22 x 20.5 x 20.5 cm (width x depth x height)

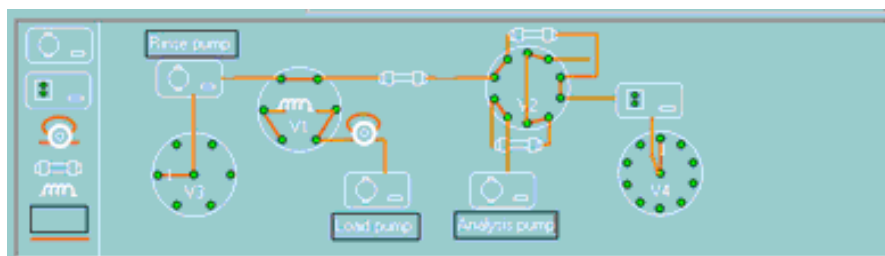
Ordering Information

Part Number	Description	
LC08	LC-08 stand alone version Includes fittings for the 12 ports, a remote cable, and power supply	
LC08-01	LC-08 stand alone + PC control Includes fittings for the 12 ports, a remote cable, power supply, RS232 cable, USB/RS232 converter, and control software	
LC08TK	Column connection kit	

Software for Control of Valco Valves

User Manual

(Version 1, January 2009)



PC-Tech

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Warranty: Valco valve control software is warranted from defects for a period of 365 days from the date of shipment. The warranty for defects is limited to the purchase price of the product. PromoChrom Technologies should not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of the material.

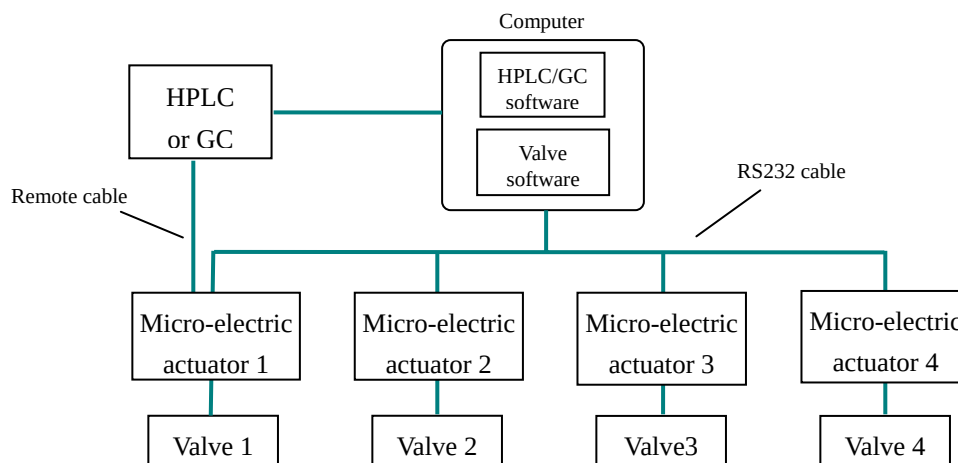
PC-Tech.

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1. Introduction

The valve control software is designed to interface with Valco (VICI) GC valves and HPLC valves. It can control up to four 2-position and multi position valves with micro-electric actuators. The following diagram shows how the software works with the valves.



The valve control software communicates with the micro-electric actuators of the valves via RS232 communication. When HPLC or GC starts a run, the remote cable will pass the signal to one of the micro-electric actuators. The information will then be received by the valve software. It will start a method accordingly. The software is compatible with any HPLC or GC that has a TTL output or a contact closure output. Examples of HPLC and GC with TTL output are the 1100 LC, 1200 LC and 6890 GC from Agilent Technologies. Among the HPLC with contact closures are those from Waters and Shimadzu.

2. Installation

The valve control software includes a resource CD carrying the control software and user manual. Depending on selection of options, a RS232 cable, a remote cable or a USB/RS232 converter are also included.

2.1 Install USB/RS232 converter

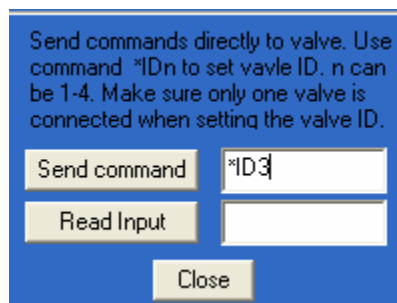
The software uses RS232 port to communicate with the valve. If the computer does not have a RS232 port, a USB port on PC can be converted using a USB/RS232 converter. Plug a USB/RS232 converter to a USB port on PC. When asked for driver, insert the CD included with the converter. Follow the instruction to complete the driver installation.

2.2 Install software

Close all applications on the computer. Insert the resource CD into the CD drive. Open folder “Valve control software” and click at setup.exe. Follow the instructions given on the screen to complete the installation. If the PC gives warnings during the installation, select “ignore” to complete the process.

2.3 Set valve ID

The software uses valve ID to differentiate the valves. The ID is set as 0 when a valve is shipped from the supplier. It needs to be converted to 1, 2, 3, or 4. Connect one valve to PC using a RS232 cable (available from Valco and PromoChrom). Supply the power to the valve. Launch the valve control software. Click at menu bar “Diagnosis”. It will show a panel as below:



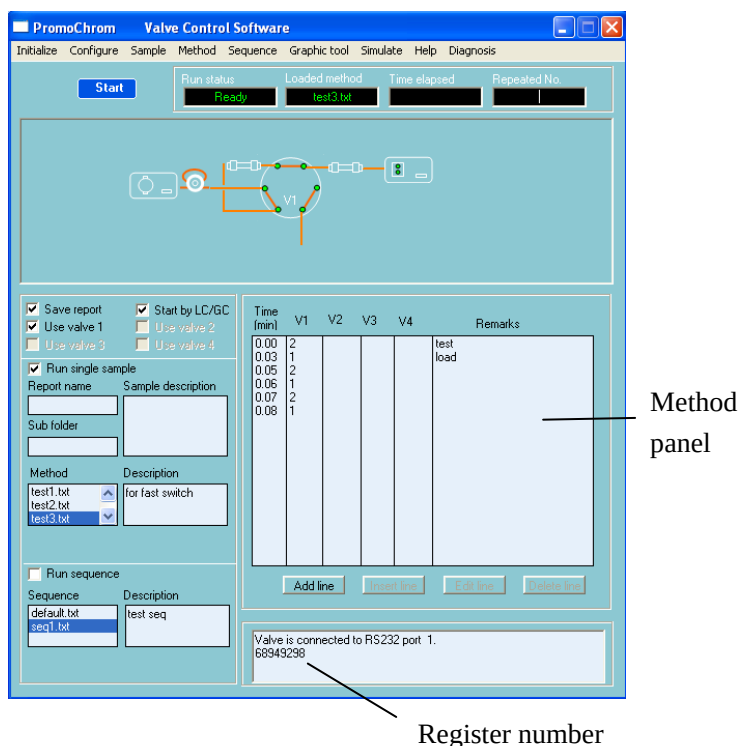
It can be used to send commands directly to the valves. Use command *IDn (n can be 1, 2, 3, or 4) to set the valve ID. Make sure only one valve is connected when setting the valve ID. The valves should not have the same ID.

The diagnosis panel can be used to set other parameters for the valves and obtain the current valve settings. For example, command 1GOA will switch valve 1 to position A (if it is a 2-position valve). The detailed commands are give in the Valco user manuals.

2.4 Install valves

Follow the instructions in the user manual from Valco to connect the valve motor and the power supply to the micro electric actuator. Use RS232 cable to connect the actuators to PC.

3. Operation

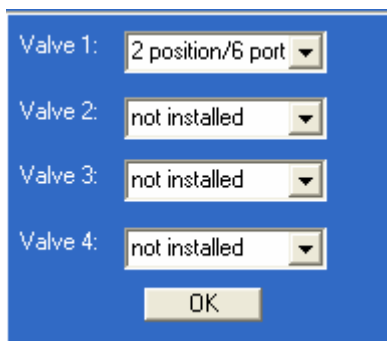


3.1 Obtain license key

When the software is launched at first time, it will generate a register number and ask for license key. The software can be used for one month without a license key. After that, a license key must be provided. The key is computer specific. One software copy can only have one key. The user needs to provide PromoChrom the register number to exchange for a license key.

3.2 Set configuration

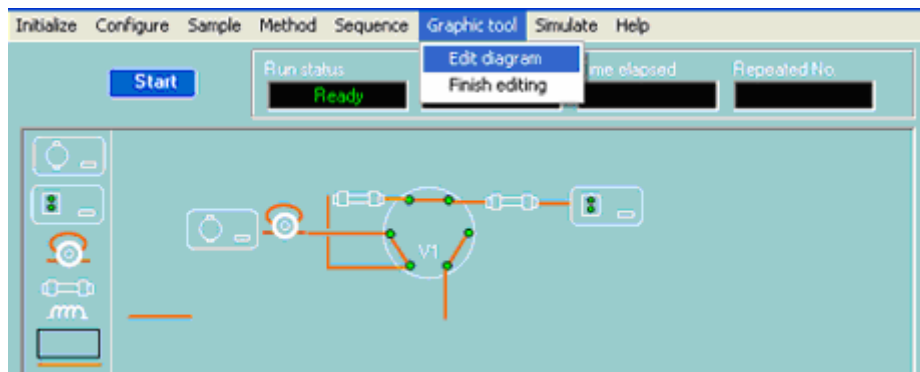
Configuration setting tells the software what kinds of valves are connected. It needs to be manually set before using the software. Clicking at menu bar “Configuration” will bring down the following panel:



Set the types of the 4 valves according to the real valve types.

3.3 Draw valve diagram

The software provides a tool box for drawing up the valve diagrams. A clear diagram can be a great help in method development and understanding. To draw or modify a valve diagram, click at menu bar “graphic tool” and bring out the tool box as follows:



A line can be moved by pointing the mouse to the left end and moving the mouse while keeping it down. Pointing the mouse to the right end can change the length and orientation of the line. The diagram can be permanently saved.

3.4 Build methods and sequences

The software provides a template file “default.txt” for making new methods and sequence. A method sets timing for valve switching. It also provides a remark section to explain the purpose for each switch. A sequence tells what method to use for each run and where to store the data file.

A method may be created using the default method as template or obtained by modifying an existing method. Below are the procedures:

- 1) Load method default.txt or load a method that is similar to your new method.
- 2) Click button “Add line”, “Insert line”, or “Edit line” to bring out the parameter entry panel.
- 3) Enter parameters for each step.
- 4) Click at menu bar “Method” at the top to save the method.
- 5) Use “simulation” function to find out the flow path for each procedure.

The procedures for making sequences are similar.

3.5 Control valves

The software provides 3 approaches for controlling the valves:

- 1) Direct switch by clicking at the valve icon.
- 2) Use method
- 3) Use sequence

A method or sequence can be started by clicking at the “Start” button in active start mode or triggered by GC or HPLC in passive start mode. In active start mode a method or sequence can be repeated automatically. This feature can be used to turn a valve into an auto sampler or an auto injector.

In passive mode, the software waits for signals from other devices to trigger the start of a method or sequence. The method or sequence will stop when it reaches the end. Details about how to obtain the remote signal are given in section 4.

4. Synchronization with GC or HPLC

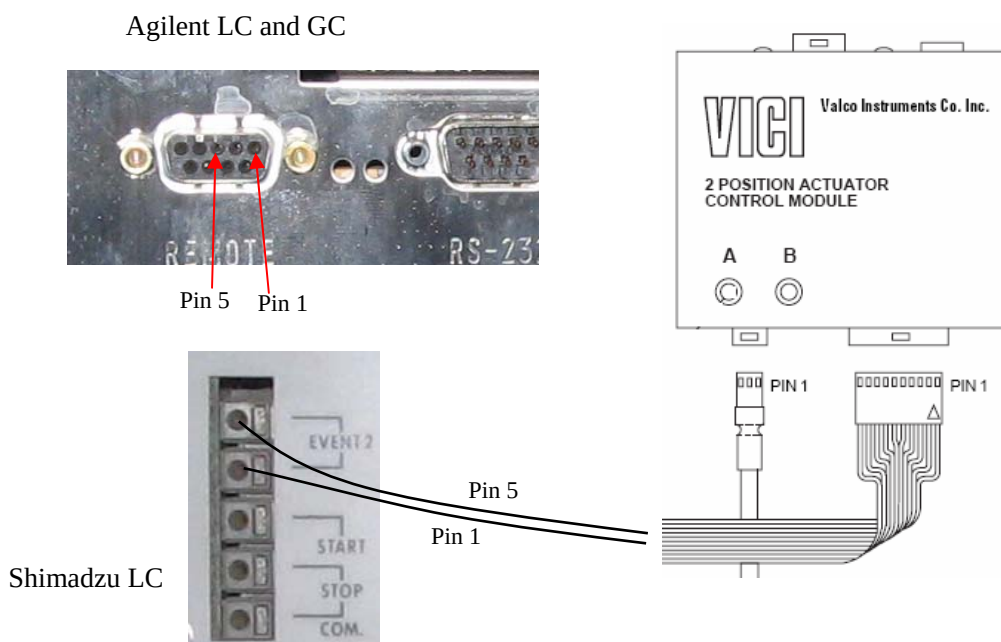
As a Valco micro actuator does not have direct input to sense the signal from HPLC or GC, the software uses an indirect approach to sense the signals from HPLC. The software is

monitoring the positions of the valves continuously. When the HPLC or GC sends out a remote signal, it will trigger a position switch for one of the valves. When the software senses this change, it will start the method or sequence. So the first valve switch is done by the HPLC or GC, not the valve control software.

The 2-position actuator has a 10-pin port for the manual controller. The multi position actuator has a 26-pin port for the same purpose. These ports can be used to interface with HPLC or GC. Below is an example for sensing the start signal from HPLC using a 2-position valve.

- 1) Use command 1SM2 to set the digital input mode of valve 1 to 2 using the diagnosis panel.
- 2) Make a remote cable that lead pin 1 and pin 5 from the actuator 10-pin port. The remote cable can be made using cables for connecting the manual controller. Pin 1 is ground and pin 5 is for valve switch.
- 3) Connect the other end of remote cable to a contact closure (for Shimadzu or Waters instruments) or a remote port (For Agilent instruments).

Under mode 2, when pin 5 is connected to ground (by closing a contact closure), the valve will toggle its position. The valve will also change position when pin 5 is set to logic low by a remote logic signal. The following diagram shows the connections:



For connection with an Agilent instrument, a cable with special adapter is needed. It can be ordered from PromoChrom.

5. Troubleshooting

5.1 The software cannot communicate with the device The cause could be inappropriately connected RS232 cable or a jam on the communication port. First check the cable connection and click at “Initialize” menu bar to make a reconnection. If the problem still exists, unplug the USB/RS232 converter from PC and plug it back again.

5.2 The HPLC cannot synchronize with the software When a remote cable is used, make sure the start wire and the ground wire are correctly connected to the terminals of the contact closure on the HPLC. In the method or instrument control of HPLC, make sure the contact closure will close when it start a run and will open when a run is finished.

5.3 Other problems An effective way of solving problem is to power cycle the valves and the computer.

6. Features

6.1 Editable valve diagram A graphical tool box for drawing the diagram is included. Users can build the instrument diagram according to actual valve connections. The software will memorize the drawing permanently. It helps to turn a normal HPLC or GC into a special analyzer.

6.2 Real time display flow path The software monitors the status of valves continuously. Whenever a valve is switched, the flow path diagram will be updated.

6.3 Help tools for method development A simulation function is included. Users can do stepwise operation of a method and observe the change of the flow path. For each step of a method, a remark can be added to explain the purpose of the line. It makes the method easy to understand.

6.4 Multiple control approaches The valves can be controlled by 4 approaches: 1) switch by a mouse click at the valve icons; 2) switch by HPLC or GC using contact closures; 3) switch using methods; 4) switch using sequences.

6.5 Flexible configuration The software is offered as 1, 2 or 4 valve configurations at different prices. Users can choose a suitable product according to their applications. The software for 1 and 2 valves can be upgraded when it is necessary.